The *GEO* Quarterly

Group for Earth Observation

**The Independent Amateur Quarterly Publication for
Earth Observation and Weather Satellite Enthusiasts**

Number 18
June 2008

Inside this issue . . .

Ed Murashie presents part 3 of his series on GOES LRIT. This time, Ed details the LRIT structure and processing, amply illustrated with helpful flowcharts.

Interference has always been a bugbear for the legions of APT enthusiasts. Alan Sewards provides an update to his seminal article on the subject, detailing the causes and providing illustrations to assist recognition of the likely source.

The cover image at left depicts a spectacular sand and dust storm that swept across eastern Europe last March. A team of GEO observers followed its progress and helped to produce our illustrated report on the event.

Douglas Deans presents the first of his new-style columns devoted to problems readers experience with their computer systems.

There are also articles dealing with MODIS imagery, the Russian Buran shuttle, an update on the Aral Sea and much more ...

The eye-catching satellite image on the front cover of this issue depicts an exceptional dust storm that transported huge quantities of sand from the eastern Sahara desert, over the Mediterranean Sea, and deep into eastern Europe. Several readers made reports, both from satellite imagery and the ground, and these form the basis of our article on page 33.

The GEO Survey we asked you to participate in last issue has been a total flop thus far. By mid-April only 11 readers has bothered to respond. Suffice it to say that the GEO Management Team is bitterly disappointed at this show of apathy from the readership. You can read more on page 3 explaining why GEO requires your input. The survey remains open for GEO Quarterly <u>readers</u> at

http://www.geo-web.org.uk/survey08.html

Ed Murashie's series on LRIT has already engendered interest and his latest offering appears on page 17, where he gets to grips with the structure of the LRIT transmissions and describes the software he has developed to decode the signals. Ed is keen to hear from fellow enthusiasts interested in developing LRIT systems.

Despite the popularity of *EUMETCast*, good old-fashioned APT remains one of the mainstays of our hobby. The downside is, of course, that the VHF NOAA transmissions are prone to interference. Some years ago, Alan Sewards compiled a seminal report on identifying and dealing with interference, and this used to be available on the EUMETSAT website. This version is no longer available, but Alan has kindly updated his article for GEO readers (page 25).

Finally, apologies to the two dozen or so readers whose copies of GEO Quarterly 17 contained missing and duplicated pages. All have been provided with replacement copies. We hope this has not spoiled your enjoyment of the issue. This was a production issue outwith GEO's control.

Contents

The GEO Report

Francis Bell

My usual welcome to new members of our group and of course thanks to those established members who have renewed their membership. We do need a strong membership base, not only for financial reasons (because we have no other source of income other than our members subscriptions) but because we need a substantial number of talented people in order to interact with those national and international agencies who are responsible for Earth observation and the subsequent data dissemination. With these objectives in mind, please do not forget your renewal when it becomes due.

It's GEO management policy to attend conferences and meeting where we think it is beneficial to both the organisers and to GEO. There is a report on page 15 about GEO's presence at the *UK Space Conference* held in Godalming, Surrey.

The GEO Stand at the Space Conference

Looking at the coming months I notice there is an International Astronautical Conference taking place in Glasgow from September 29/October 3, 2008. Perhaps some of our Scottish members would be willing to attend and represent the interests of GEO together with some display. See

www.iac2008.co.uk

A very high priority for us must be the NOAA Direct Readout Conference in Miami next December (see page 7). GEO must interact with NOAA if we are to keep abreast with developments within their programmes; also NOAA may wish to know about the user group which GEO represents. I have been to the equivalent of this conference twice before.

[*Francis and Nadine Bell are planning to attend this conference to represent GEO and illustrate the talents and activities of our organisation—Ed*]

Snow Thwarts GEO

Disappointingly, GEO missed the Spring radio and computer rally at Kempton. Apologies to everyone. Three of us were ready to attend, with cars loaded, when it started to snow heavily at about 8.00 am and radio reports indicated traffic problems on some of the main roads. It was a disappointing decision, although correct at the time, as we decided not to go. I hope we will be at their Autumn rally.

Our Leicester symposium will be over by the time this Quarterly is circulated. At the symposium I always publish our accounts and have available an up-to-date statement of membership numbers. For those not attending, the figures are approximately

- Money in bank £13,500
- Cost of a Quarterly publication and its distribution £2,400 per issue
- Total membership is about 530, three quarters in the UK.

I hope most of the above comments have been positive and forward looking. However, there are disappointments.

The lack of feedback and involvement from many members to the website questionnaire—which took a lot of effort to design and establish—has only generated a trickle of replies (read more on page 3) and raises the question: '*Why bother running GEO?*'

The GEO Management Team are fully committed to the organisation but I also know that for some, their time commitment is at saturation level. These are issues which will be discussed at Leicester.

Storm Dunlop speaking at the U3A

University of the Third Age

Last year, I gave a talk to the local branch of the University of the Third Age (U3A). I guess it was well received because I was asked for another talk this year. As usual, I try for live weather satellite reception, which does require planning and resources, but is worthwhile because live images do generate interest. Keen not to offer a rerun of last year, I invited Storm Dunlop to show his images of '*Weather from Above and Below*', photographs of clouds and meteorological phenomena taken from the ground in combination with images received from weather satellites. Storm, who you may remember is the author of many books on the weather and clouds, readily agreed, and his presentation was well received by the 35 members present. GEO's live display and literature handouts also created worthwhile interest. Thanks also to John Tellick who came and supervised technical matters for us.

If GEO are invited to the AMSAT-UK colloquium scheduled for July 25-27, 2008, we will do our best to attend. In the past we have put on live demonstrations of weather satellite reception and given talks in their lecture stream. Our last issue showed <u>incorrect dates</u> for this event.

The dates shown above are correct. I hope this error did not inconvenience anybody.

EUMETCast Matters

At home here, I continue to experiment as I expect most of us do. Hearing a story that there was reduced signal strength coming from EUMETCast /Hot Bird-6, I immediately deployed my smallest dish, measuring about 40 cm in diameter, but still received a very strong signal: so if there was a dip in the signal strength I missed it. Experiments continue on other aspects of reception; I keep getting missing segments and don't know why. Well it will keep me occupied and an excuse for neglecting the garden.

Hampshire Brownies

Together with the local amateur radio club, GEO provided a small demonstration to a Brownie group in Hampshire. Once a year the Brownies have a '*Thinking Day on the Air*' which

involves live amateur radio contacts and the use of the Internet. Even at a very young age these Brownies did take an interest in the live images of the Earth which were also on show.

This photograph shows from left to right Francis Bell, Tansey, Hannah, Lucy, Jessamy and District Commissioner Louise.

QUARTERLY QUESTION

My thanks to those members who took an interest in the March Quarterly Question, which asked whether any part of mainland Iceland was within the Arctic Circle. The answer is no. The most northerly point in Iceland is Hraunhafnartangi which is 3 km short of latitude 66 degrees 32 minutes north. However, the Arctic Circle does cut through the offshore island of Grimsay.

Of course I asked the question because the answer was likely to be marginal: that is just 3 km short of the Arctic Circle.

My thanks to the following members who submitted a correct answer: Rob Denton (Bulgaria), Colin Cox (England), Aime De Grysé (Belgium), Erick Thirkell (Scotland), Mike Bragg (New Zealand) and Andreas Lubnow (Germany).

The June Question
The current Quarterly Question was prompted by my reading the British National Space Centre's (BNSC) recent publication *Space:UK,* issue 23, which contains a short article about the Earth's atmosphere, and where it stops and space begins. Most of us are used to living in our atmosphere with a pressure of about 100 kPa. This pressure reduces steadily with altitude above the Earth's

surface, and the question is:

'When does atmospheric pressure become zero, or, putting it another way, where does space start'.

This rather indistinct boundary is called the thermopause and is defined as the distance from the Earth where any particle present is just as likely to drift off into deep space as it is to stay associated with the Earth.

This boundary is likely to vary a little according to solar activity so I will happily accept plus or minus 10% of the reference answer. I will use as the reference answer the figure published in *Space:UK,* where a figure, in kilometres above the Earth's surface, is quoted. I expect many other space related reference books will quote a similar figure.

A clue to the answer: surprisingly the International Space Station would not qualify for being in space with respect to the thermopause although geostationary satellites would qualify as being in space. What about polar orbiting weather satellites? Decide for yourself!

Please email answers to Francis Bell at

francis@geo-web.org.uk

Dismal Response to GEO's On-Line Survey

From the Editor

One of the first items you would have read after opening your March 2008 copy of *GEO Quarterly* was a request to help GEO, and your editor in particular, by completing our on-line survey. Rather than write a tirade of invective to describe the outcome, I'll let the figures speak for themselves.

Only 11 readers, at the most, 2% of of the GEO membership, took the opportunity to make a return

While there is never the expectation of a 100% response, this dismal effort is a real slap in the face for GEO's Management Team, and particularly myself, as we strive to provide you with relevant articles on topics of interest to you.

> As editor, I put in between 150 and 200 man-hours on every issue of *GEO Quarterly*; I hardly think it is an imposition to ask readers to reciprocate by spending five minutes or so of their time completing our on-line survey!

Why do we need your input?
The face of weather satellite imaging has altered radically since GEO first appeared on the scene in 2003. For those with plenty leisure time, *EUMETCast* provides for their every need: non-stop Meteosat animations; geostationary images from around the globe; NOAA HRPT images of the UK and Europe; plus planet-wide imagery from Metop-A. And *GEO Quarterly* has dealt with all these matters at considerable depth over the years.

But, as Laurence Holderness's piece on page 6 illustrates, not everyone fits into this category. There are readers who are uncomfortable downloading this tidal wave of data into their PCs. We have to cater for those with less demanding requirements too, specifically to retain our current members, but, even more importantly, to encourage new, younger enthusiasts to the fold. A recent survey carried out by our Dutch counterparts, *Werkgroep Kunstmanen* (where over 30% replied to their survey) showed one worrying feature—they had only five members younger than 50 years of age. Judging by those who have attended GEO Symposia over the years, it is probably a similar story in the UK.

In order to tailor *GEO Quarterly* to the needs of the membership as a whole, we really do need to know

- What type of satellite data you are receiving
- Which types of article you enjoy most in GEO Quarterly
- The types of topics you wish to see in GEO Quarterly
- What improvements you would like to see within GEO
- Comments you have concerning GEO, the Quarterly or the GEO website
- How can we make our hobby more accessible to newcomers?

Please type the following URL into your web browser and spend just a few minutes completing our survey form

http://www.geo-web.org.uk/survey08.html

Note that, as this is a survey for magazine readers only, there is no link to the survey form from our website's home page. And of course, any reader who wishes to make a more extensive reply/comment, is welcome to e-mail the editor, as Laurence has already done.

Satellite Imagery in GEO Quarterly

Les Hamilton

Although the response to the *GEO Survey* has so far been totally underwhelming, there was one telling comment from Peter Bartlett that really caught my eye:

"In the March 2008 edition I have noticed the majority of the satellite images you use are professional rather than those captured by members. I assume this to be because these images cover the topic in question; or is it you are not receiving members images."

Peter has a point, and is correct on both counts.

Images covering a Topic

Despite having a membership in excess of 500, the vast majority of GEO members contribute *absolutely nothing* to the Quarterly. The outcome is that an inordinate proportion of the articles that you read in the pages of this publication are penned by myself: and here's the rub—I do not possess a *EUMETCast* system; therefore I have no direct access to the wealth of MSG, NOAA and Metop-A imagery that this provides. My 'live' satellite activities are confined to APT. When I write a piece for the Quarterly, I always try to illustrate it with the best possible images—which means MODIS images from NASA and HRPT images from the NOAA CLASS Archive. There is the odd exception, such as Eric Dean's image that was used in the December 'Aral Sea' article, but as the Aral is out of range of my APT system, most of the images were sourced elsewhere.

Images submitted by Readers

One of the greatest disappointments I have experienced throughout GEO's existence has been the apparent unwillingness of the readership to share their images through the pages of the Quarterly.

The number of readers who do make an effort to send in images from time to time can be counted on the fingers of one hand! You can check this by reference to the image credits that regularly appear in the Quarterly.

GEO has hundreds of members who download—probably—terabytes (i.e. virtual bucketloads) of images from Meteosat, the NOAAs and Metop

annually, via *EUMETCast*. It really would be uplifting to receive images of interesting areas and cloud phenomena from you.

Guidelines for Images

Anticipating a minor flood of images for the September issue of GEO Quarterly, here are a few simple guidelines as to what we require.

'Dont's

- Don't send in full-disc Earth MSG images or extended (15 minute or greater) strips from NOAA-18 or Metop. If these are reproduced in the Quarterly, they will look no more impressive than APT images.
- Don't send images defaced with text, brightly coloured country outlines or latitude/longitude gridding. Satellites do not image these.
- Don't process your images in garish bright green tones that make them resemble maps from a school atlas.

'Do's

In the 21st century we need to take advantage of the superb 1-kilometre imagery available from the currently operating Earth observation satellites.

- Be selective. Look for small regions that show interesting features, either of land or cloud, when viewed at the full 1-km resolution available.
- Select high-resolution segments that illustrate a region of the planet with an interesting story behind it: and add a few lines of descriptive text for our readers.
- Send images either in monochrome, or processed with colour that look as nearly natural as possible

Note: astronaut photographs from orbit clearly show that land features on Earth are generally brown, *not* green.

Exceptions

There are, of course, occasions where overlays of various kinds are appropriate, as on page 8, where an article deals with an analytical aspect of satellite imagery. But on stand-alone images, please consider them taboo.

So come on! Any reader could find their images displayed in GEO Quarterly—even on the front cover. All it requires is a little effort and a sharing mentality.

Finally

Just days after compiling this page, I received an email from David Donnelly, offering to send GEO Quarterly images from his new location in Australia. This is what we need more of! Part of David's e-mail, and the informative text he sent with the image, appear below.

Australia in APT

David Donnelly

I am a keen reader of GEO Quarterly and have been a subscriber since you first began publication. I have recently moved from New Zealand to Alice Springs in central Australia and now have my APT system working here.

I have been receiving some impressive images at this location and was wondering if you would be interested in any southern hemisphere images that I have recently received? Thanks for an interesting magazine.

—————

The APT image opposite was received during a NOAA 18 pass on April 20 this year from my home in Alice Springs. It was received on a home-built RX-2 receiver using a homebrew QFH aerial then processed using *WXSat* software.

Timor is clearly visible in the top left corner of the image. Papua-New Guinea is the Island obscured by cloud at the top right.

The lake, partially covered by cloud at the upper left of the continent, is Lake Argyle. Whilst it appears relatively insignificant this lake is the largest man-made lake in Australia and covers an average area of 1000 km^2, equivalent to 18 times the size of Sydney harbour.This lake was created by a dam on the Ord river and has supplied hydro-electricity and irrigation water to the region since the early 1970s.
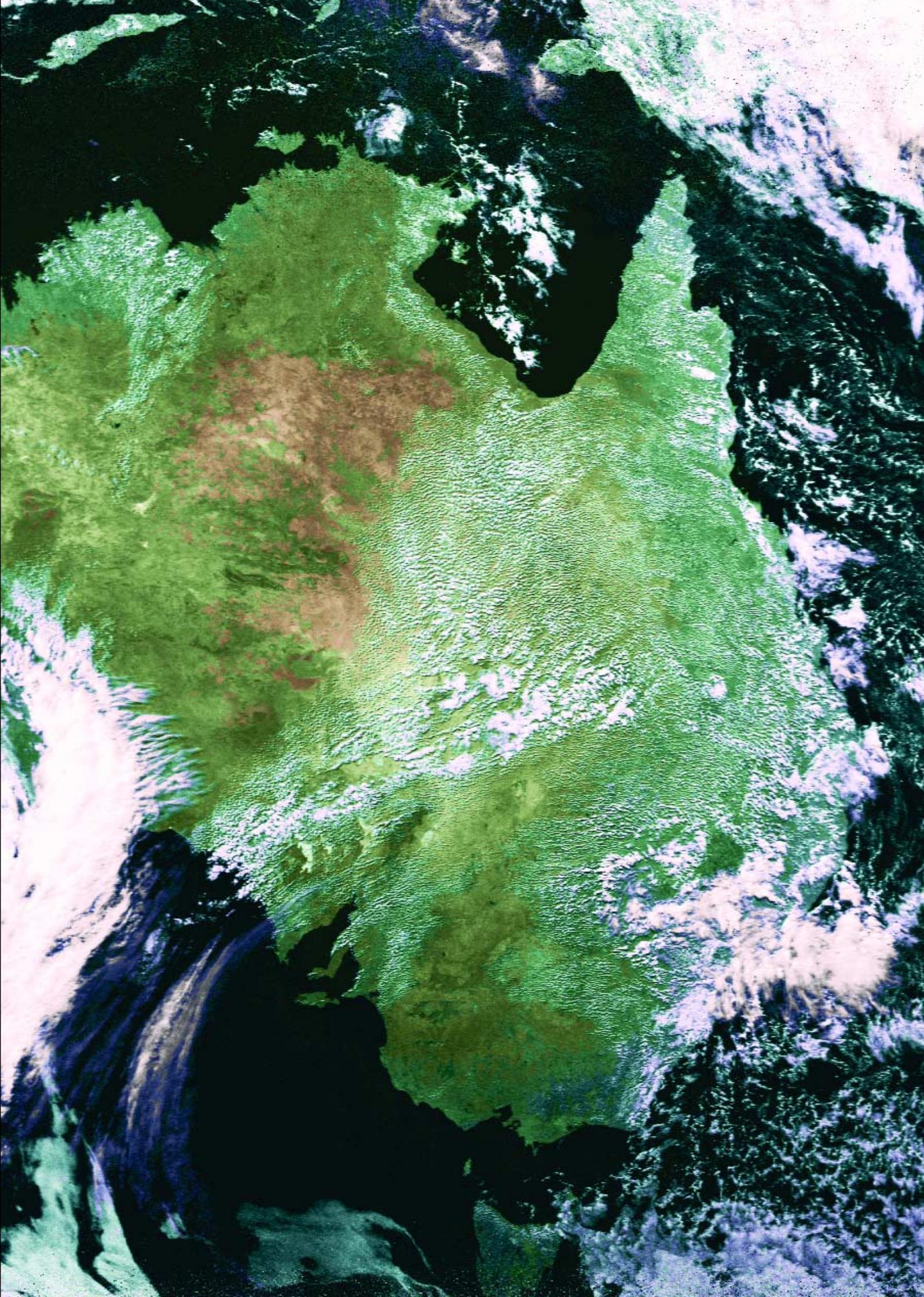
The Current Weather Satellite Scene

One Reader's View from the GEO Survey

Laurence Holderness - GW0CCO

Following completion of GEO's on-line survey, I thought that certain matters could be usefully expanded upon, hence this write-up. My thoughts are intended as constructive criticism on GEO and the weather satellite scene as a whole.

Both my wife and I enjoy reading GEO Quarterly and the various articles therein, and consider it to be an excellent magazine. Pictures and articles are excellent. However, since the launching of the MSG series of satellites, we both feel that the content has now become much more technical. Also, many articles have a fair amount of computer programming in them. This I am sure is putting people off joining the group. Let me try to explain in my own way.

I understand that satellites in the MSG series are much more technically advanced units, and as such, more sophisticated equipment and software are required to view the downloaded data. However, I am sure that many of 'older school' of weather satellite enthusiasts cannot understand it all, especially those in some of the less developed countries.

With the early VHF APT satellites it was easy to get started for a small outlay, and one had the excitement of receiving pictures up to four times per day. A very low specification computer was suitable for the job, producing good images, while the software was simple to use. A receiver could even be built from a kit and aerials could be home-made.

Now we have gone to the other extreme whereby two PCs are recommended, both with high spec's. The receiver is normally a card inserted into the PC, while the aerial system consists of a dish, amplifiers and LNBs. Then there is the need to obtain licenses, etc. On top of this there appears to be a great deal of initial setting-up, with lots of various software packages required to obtain the finished pictures.

From various articles in *GEO Quarterly*, there also appears that a lot of programming is required to make things work as required. There also appears to be far too much data to manipulate just to obtain an image from the newer current systems. This necessitates a large storage area and also file management systems etc, which many of use do not want to have to deal with.

OK, I know that you can now receive pictures all day long, but a lot of the pleasure was the reception of pictures from polar orbiting satellites actually passing overhead a number of times each day. With all day reception this anticipation of arrival no longer exists!

Whether this is all necessary, I cannot say; but I am sure that it puts lots of people off even trying. While I am very good with my hands and at using a range of computer programs, I find that programming leaves me dead. As such I am not interested in it. I was never able to get into a position to learn programming, possibly because I was too old when I first started using computers. No doubt many others were/are in a similar position and feel the same way as I do.

What we want is a simple system that will work without a lot of fuss.

I am sure that many of the original members were happy with the basic APT reception and now find that that they cannot afford the equipment required for the current systems. Neither do they have the expertise or time that appears to be necessary to get the final picture. Also many are younger persons who have family responsibilities that must come first, and cannot spare the time to learn to manipulate the various intricate software programs needed to get that final picture.

I feel that those who do are really dedicated to the hobby, and may have a lot of programming experience, possibly from an early age, through their employment, making it all relatively easy for them.

As in many hobbies, there are those who want everything to be just perfect, and while we admire them for that dedication, we cannot all each that level. Unfortunately, there does not appear to be any one locally (in Pembrokeshire) with up-to-date knowledge of the current systems. While David Taylor and others are very happy to answer people's questions, this cannot take the place of hands on experience. One of the problems of living in the far West of Wales.

Many, I am sure, just want a simple system similar to those used for APT, and are quite happy to just receive pictures every few hours or so with a minimum of self activity. Good basic instructions to set up such a system, using just one PC and the minimum of software etc. would be much appreciated—and might well bring fresh members into the GEO fold.

I did think that MetOp would be the answer, using a fixed QFH or turnstile antenna receive VHF with LRIT, especially when the current NOAAs close down. However, I see from your web site, that this function of MetOp has died and will not be available until possibly 2012. Oh well—that's satellites for you!

So what now? What we want is something new, which is inexpensive to purchase and with easy-to-use software, as an alternative to the MSG satellites. However, the problem is this: 'Is there anything in the pipeline to fill this gap?' If there is then you may well have an increase in GEO membership, especially if the content were to cater for this type of operation. At the moment APT seems to be virtually ignored and on it's way out.

I fear that if there are only the MSG type of satellites, then membership will drop, especially as older members pass on, as there will not be the younger members to fill their places.

Conclusion

Sorry if I have seemed to have rattled on a bit, but these are my thoughts and also those of a few friends who, while interested in APT, are not prepared to go the whole way with the MSG systems.

It is also a fact that many other clubs and concerns, have similar problems. Older members appear to carry all the burden of running the club with very few younger members. Family ties and money often dictate when and *if* someone will join a club; and of course, a club with no younger members has no one to guarantee continuity into the future. I hope that this will not be the case with GEO, so what we want is some way to encourage youngsters to join.

Editor's Comments

Interestingly, and probably surprisingly to the large band of dedicated *MSG-EUMETCast* enthusiasts within GEO, I tend to share many of Laurence Holderness' concerns about the way weather satellite imaging is currently going.

I am interested in weather satellite imagery, but not in 24/7 reception or creating animations of MSG imagery around the clock. I consider myself to be highly

computer literate; I write computer programs in several languages. But at no time have I even vaguely considered setting up an MSG system of my own. Having read in the various Internet forums of the problems so many members have experienced setting up their MSG systems, particularly with the software, I am just not interested in the hassle. I have far better things to do than spend even more of my life wrestling with problems on my PC and downloading a torrent of satellite imagery! What I need to whet my enthusiasm would be a software package that simply 'runs out of the box'.

If a seasoned computer user like myself feel this way, just consider how a complete newcomer to the hobby feels when confronted with the contorted and involved procedures required to equip onself for EUMETCast reception: the hardware, software, licensing etc.

I neither want nor require images every 15 minutes. I've seen animations—and they are indeed captivating: but I don't need them. As Laurence states, individual images several hours apart are sufficient for many people. And of course, EUMETSAT does provide the free 'essential data' from MSG every six hours, for which no license, nor a hardware key for the computer, are required.

Is a simplified, entry-level means of getting started with MSG-EUMETCast required, one that anyone with a PC can achieve without having to download gigabytes of files per day; one that simply deposits a few desired images in a folder on the hard drive without any user intervention (other than running the software).

The Challenge

So here is my challenge.

- Is it possible to produce a piece of software that will, exclusively, receive and process this 6-hourly MSG data, leaving only the jpeg images on the host computer?
- Such software should accept and process only a restricted set of MSG channels, say one visible and two infrared—just sufficient for creating simple colour composite imagery as currently with the NOAA satellites.
- The software should have a minimal set of operations, perhaps restricted to selection of HRIT or LRIT, and which of the three allowed channels is required.
- It should be possible to run the software at, say, 11.45, just leave it to collect the desired images (provided the appropriate dish antenna, LNB and DVB receiver card are installed) and know that you can switch it off again once the images are 'in the bag'.

I have little doubt that such an innovation would attract newcomers to our hobby as never before. And of course, once hooked by the images, doubtless a goodly proportion would, in time, aspire to the full package.

Readers' Views

What do GEO Readers think? Please add to the debate by emailing your thoughts and comments to the editor at

geoeditor@geo-web.org.uk

Call for Papers

NOAA's 2008 Satellite Direct Readout Conference, December 8-12, 2008, Miami, Florida

The 2008 Satellite Direct Readout Conference is the 8th Conference organised and supported by NOAA to provide information regarding the direct readout from meteorological and environmental satellites and prepare users for upcoming changes to both satellite series. The goal and expectation is for strong international collaboration. Past conferences have attracted audiences from 30 to 40 countries. The conference will consist of speaker presentations, poster sessions, exhibitors, and many opportunities for user feedback.

More information can be found at the conference website at:

http://directreadout.noaa.gov/miami08/

Abstracts and corresponding posters are solicited for this conference on both current and future geostationary and polar satellites. This includes topics pertaining to instruments, products and applications. Of special interest are posters describing examples of the link between research and operations (or between operations and research).

Please send your abstracts electronically via email to

nesdis.dro.conference@noaa.gov

Please indicate your preference for an oral presentation or a poster. NOAA conference personnel will choose the format most suitable to showcase your work. Posters will be given maximum exposure, with ample time for presenter and audience interaction. Abstracts must be no more than one page in length, in 12 point Times New Roman font.

Deadline for abstracts is July 1, 2008.

Receive APT on the Apple iMac using WxToImg

Fred van den Bosch

Since the beginning of 2008 I have had a new 'toy': an ***Apple iMac G5***. Primarily for image processing, I have also tried it for polar satellite reception. WxToImg [1], the program I use, also has a *Mac* version, so I played a bit with it. The present version (2.8.12) has a couple of advantages. For me, the most important is that you can choose one of the six templates for easily generating a web-page and then upload it to your website [2], all fully automatically.

One of the problems I noticed was with the *Mac* soundcard. You can only switch from the default 'Microphone' to 'Line-In' by using the system preferences.

The only hint I got after posts on some Mac-forums was to use *Automator*, a program to automate tasks, but it was not really user-friendly—so I decided to make up something in *AppleScript*, as usual, not bothered by any knowledge of it. After a lot of *Googling* and cut-and-pasting I now have something that works. You can download it from my website [3].

Any questions you wish to ask about it can be posted on my forum [4].

References
1 WxtoImg
  http://www.wxtoimg.com/
2 Fred van den Bosch,
  http://www.fredvandenbosch.nl/satellites_polar.html
  and follow the links to 'Europa' and 'Enhancements'.
3 Fred van den Bosch,
  http://www.fredvandenbosch.nl/downloads_General_files.html
4 **http://tech.groups.yahoo.com/group/POVIM-Software/**

GeoSatSignal Animations

with Meteorological Chart Overlays – Update

Terence Smith

A number of minor points have cropped up whilst I have been fiddling with programs since the New Year.

1 If you have two or more animation files in the same directory, for display in *Irfanview*, then (if configured for this) it is possible to switch between them using the left/right cursor keys; otherwise, using these will advance or back up the frames.

2 Should you have problems with I-view locking up when set to loop an animation, or failing to update every 15 minutes as scheduled, then one can reset the schedule that opens I-view to an interval *slightly longer* than the time taken for your animation to run through, e.g., 1 or 2 minutes. The program should then update and remain looping more reliably.

It may be that high specification computers and fast networks will not suffer this problem; but if yours does, then the above might be a useful work-around.

3 With Windows XP, the Task Tab window, opened when clicking 'Properties' for a given task in the Windows Task Scheduler, shows the check box to enable the schedule, and a <u>further</u> check box immediately above which, when ticked, makes the schedule 'Run only when logged on'. When enabled, this obviates the requirement for password entry when setting up the task. The schedule will then run without that requirement (I believe from limited testing).

This check box is NOT available in Windows 2000, but is present with Vista, although the latter O.S.'s scheduler is only available to the administrator's account. Vista's Task Scheduler has been somewhat hidden away and its "front" much altered; it is now to be found under Administrative Tools within the Control Panel.

Finally, David Taylor has kindly modified a test version of GSS to permit the animation of Multi-sensor
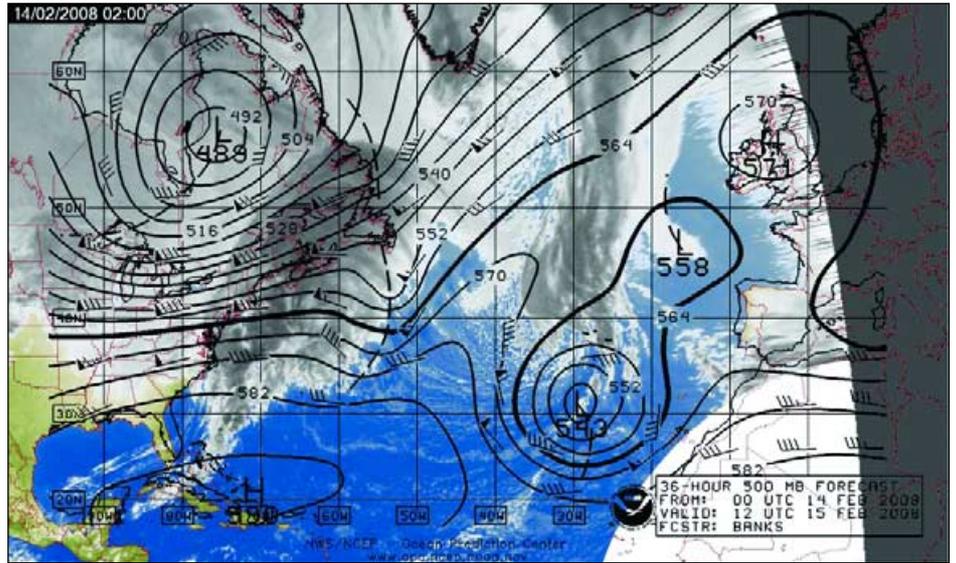
Figure 1 - A frame from a GOES-12 overlay animation created in GSS
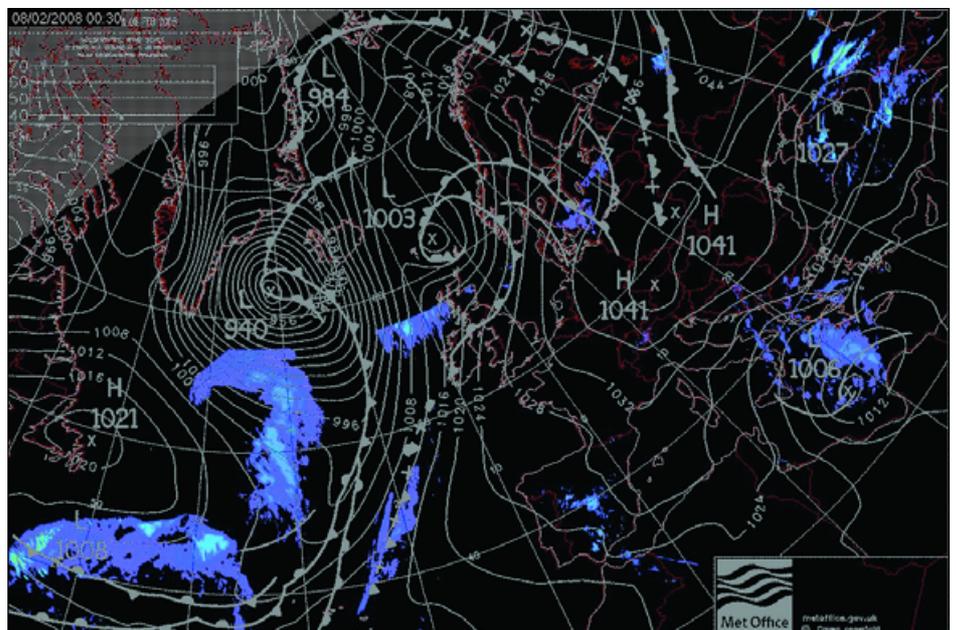
Figure 2 - A frame from an MPE overlay animation created with GSS

Precipitation Estimate (MPE) grib files, making it now possible to create an overlaid animation of that imagery without recourse to saving and renaming the Grib files as Jpeg—as shown on my web page. This may appeal only to quirky characters such as yours truly, but you never know.

Figure 1 shows an overlain image of GOES-12 IR while figure 2 is an example of an MPE overlay. Both these may be viewed as full animations on my website at

http://rifleman.org.uk/mslp.htm

A Shopkeeper's Tale

(GEO Shop Update)

Clive Finnis

Credit crunch, sub-prime, Northern Rock—what a turbulent world there's been in the financial markets lately! Luckily, absolutely nothing to do with weather satellites, I hear you say. We can all be engrossed in the fantastic images we receive, secure in the knowledge that all these crises in the world stock markets do not affect our hobby.

Sadly, wrong!

The GEO Shop buys items from all over the world and has to make purchases using euros or US dollars. Whereas the latter has stayed relatively constant to the UK pound, the euro has moved dramatically over the last few months, from an exchange rate of around 1.50:1 to 1.25:1 euros to the pound. This means that everything we buy in euros is now approximately 20% more expensive. With the narrow 'profit' margins that we work to in the 'Shop', we are now on the point of selling some items at a loss. This is not something that is sensible in any business, and with GEO's fragile finances we must take some action to counter this.

Thus we have, unfortunately, been forced to the decision to increase some

prices, in particular the popular R2FX and R2ZX APT receivers that we source from Germany. We have also been faced with increases in UK postal rates and smaller price rises in APT antennas and the EUMETCast equipment—LNBs, dishes and Sat meters—although fortunately these have been more modest than the euro exchange rate problem.

As recently publicised on the GEO-Subscribers group, we are implementing these price changes from the May 1, so they will already be in place by the time you read this Quarterly (please see the Shop page, opposite). We always endeavour to provide the keenest prices to members and if we see any opportunities to reduce prices in the future we will certainly do so.

The DVBWorld DVB-S USB-2 Box

Now for some great news for the ever-growing number of EUMETCast enthusiasts. No longer do you need to open up your PC and risk damaging it or invalidating its guarantee if you want to receive the newer Metop data. We have imported, direct from the Far East manufacturer, a new DVB-S box with a USB 2.0 hi-speed interface for

EUMETCast reception—and the even better news is that these are at a terrific price! This replaces the older USB 1.0 box which we used to sell for about twice the price. This new box can handle all the image data which EUMETCast sends, including both the geostationary and polar orbiter data, both from the regional NOAA-17 and NOAA-18 coverage and the world-wide Metop coverage—all at a stunning 1km resolution. If you are suffering missing segments with your existing setup, this box could be worthwhile upgrade.

The current EUMETCast receiver is the SkyStar II PCI card which sells (to members in the UK) for £59.50. But, by buying direct from the Far East in bulk, we are offering the new DVB-S USB2102 USB2.0 receiver for just £55.00. Of course it's just plug-and-play with no need to open up your PC, and it's ideal for use on your portable PC too. With very similar internals as the Dexatek I-Tek Sphere DVB-S box which David Taylor described in the last GEO Quarterly.

The **DVBWorld DVB-S USB2102** is in stock in the GEO Shop now. Be sure to order yours without delay.

MTSAT-1R IMAGES ON EUMETCAST

David Taylor

Readers may be interested to learn of the new format *MTSAT-1R* data which started hourly distribution over *EUMETCast* on March 4. It is slightly higher resolution than before, 2752 pixels square instead of 2288 pixels square.

The visible channel is now being sent with a linear transfer characteristic, rather than the former near square-root law, providing better potential cloud detail. EUMETSAT have also added a mid-IR channel to the *EUMETCast* stream (illustration on right).

For those who do not have *EUMETCast*, FY-2C, FY-2C and MTSAT-1R data are all available over the Internet in HDF files (which can be quite large, 200-300 MB) from the *China Satellite Data Service Center* (CSDSC). There is a beta update to *GeoSatSignal* to handle this data (registration is required).

http://satellite.cma.gov.cn/eng/index.do

September's *GEO Quarterly* will feature an in-depth article on the geostationary imagery available from CSDSC [*editor.*]
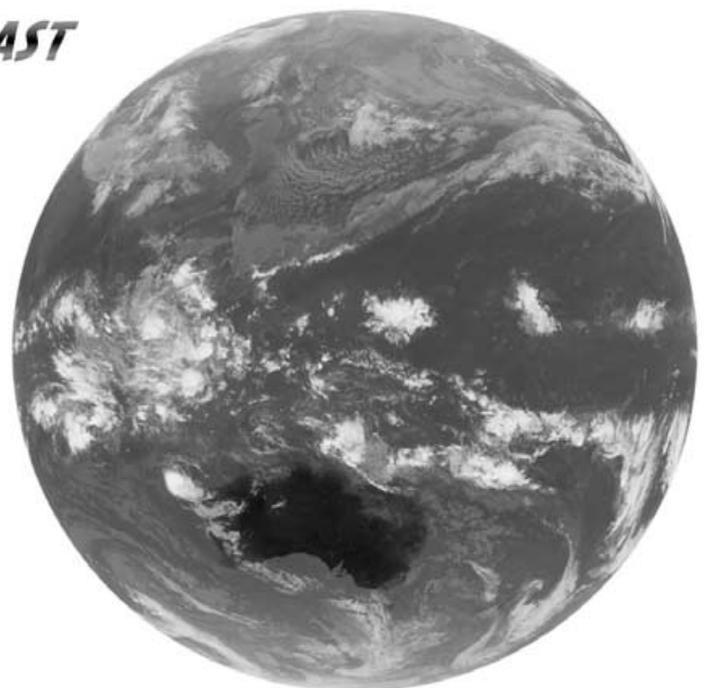
Zoom in on the Earth with

MODIS

250 metre imagery from NASA's Terra and Aqua EOS Satellites

Les Hamilton

The four years since *GEO Quarterly* first started dropping through readers' letter-boxes have been witness to perhaps the greatest-ever advances in weather satellite imagery. During this period, the development of the *EUMETCast* DVB dissemination service has brought end-users a rich variety of one-kilometre resolution imagery: geostationary images from Meteosats-8 and -9, polar AVHRR images from the American NOAA satellites plus full Earth AVHRR images from EUMETSAT's own Metop-A satellite. All these arrive direct from the Hot Bird-6 relay satellite into users' computers with minimum effort. But isn't it all becoming ever so mundane: the same material day after day after day ...

There is an alternative, offering *four times* the ground resolution. Just look at the colour image of Scotland on the previous page. It's absolutely stunning: yet the limitations of the A4 page mean that what you see here is still only displayed at 33% of its full resolution. This is a 250 metre/pixel, true-color MODIS image from NASA's *Terra* EOS satellite—and hundreds of such images are available, free of charge, almost every day of the year, to anyone with an Internet connection!

NASA's Earth Observation System

Although the public consciousness primarily associates NASA with Space Exploration, the Space Shuttle and the International Space Station, the administration has been studying our home planet ever since its inception in 1958.

In 1991 NASA launched its *Earth Science Enterprise*, a comprehensive program to study the Earth as an environmental system, with specific reference to observations of the atmosphere, oceans, land, snow and ice, and how these interact with one another to influence climate and weather. Key to this enterprise is a series of three Earth-observing satellites, *Terra, Aqua* and *Aura*, which between them carry instruments that image the planet in a wide spectrum of wavelengths [1,2,3,4]. The first two of

these carry MODIS, the Moderate Imaging Spectro-Radiometer, which images the Earth at ground resolution of up to 250 metres. Between them, *Terra* and *Aqua* provide some 300 true colour images of Earth every day. The image of Scotland was acquired by *Terra's* MODIS on February 19 this year, during that memorable spell of high pressure that brought crystal-clear skies by day and sharp frosts overnight.

Figure 1

The image segment above is reproduced at the full 250 metre resolution available from MODIS imagery. The scene was taken from the image on the preceding page and shows part of the island of Skye, with the islands of Rum and Eigg to its south and the Applecross peninsula to its north. To appreciate the scale, Rum, at lower left, measures just 13 kilometres from west to east.

A section from this image is reproduced below at full resolution to illustrate just how much detail can be resolved.

The MODIS instrument provides high radiometric sensitivity in 36 spectral bands spanning 400 to 1400 nanometres (nm) from the visible and infrared regions of the spectrum. Band 1 (520-670 nm) and band-2 (841-876 nm) are imaged at a nominal resolution of 250 m at nadir: their primary use is the delineation of land/cloud boundaries. Additionally, five of the remaining bands offer 500 m resolution while the remainder resolve at 1 km. The satellites orbit at 705 km to achieve a 2330 km swath and provide global coverage every one to two days.

The first MODIS Flight Instrument was launched aboard the *Terra* spacecraft on December 18, 1999 and the second followed on *Aqua* on May 4, 2002.

Obtaining MODIS Images

Both *Terra* and *Aqua* possess state-of-the-art direct broadcast facilities but these are out of reach of the amateur. Data from MODIS is broadcast continuously at 8.2125 GHz in the X-band. There is no receiving equipment for the amateur, who would also require to find space for an enormous steerable dish antenna as well as a means of handling over 150 gigabytes of data per orbit!

So where do these spectacular images come from? Just direct your Internet Browser to the *MODIS Rapid Response System* website at

http://rapidfire.sci.gsfc.nasa.gov/

and click '*Real-Time*' on the banner at the top of the page. This connects you with the 'Near-Real-Time Level-2 Browse' page. Be patient as it may take a few seconds to load, specially in the evenings, when upward of 300 thumbnail images need time to load. Part of this page appears at the top of page 12, and illustrates the layout. At top left are two clickable ground-track maps, one each for *Terra* and *Aqua*, to help you to quickly identify when each

satellite passes over an area of interest. Beneath appear up to 150 thumbnail images for each satellite: clicking a thumbnail displays a 2-km resolution version of the image while to the right of each thumbnail is a list of clickable links for additional resolutions up to the maximum of 250 m/pixel. The 250 m images are delivered in JPEG format and average around 8 MB in size. Images are generally provided at 5 minute intervals along the satellites' orbits though there are gaps from time to time. But if the region you require has not been imaged from *Terra*, it will generally be available from *Aqua*.
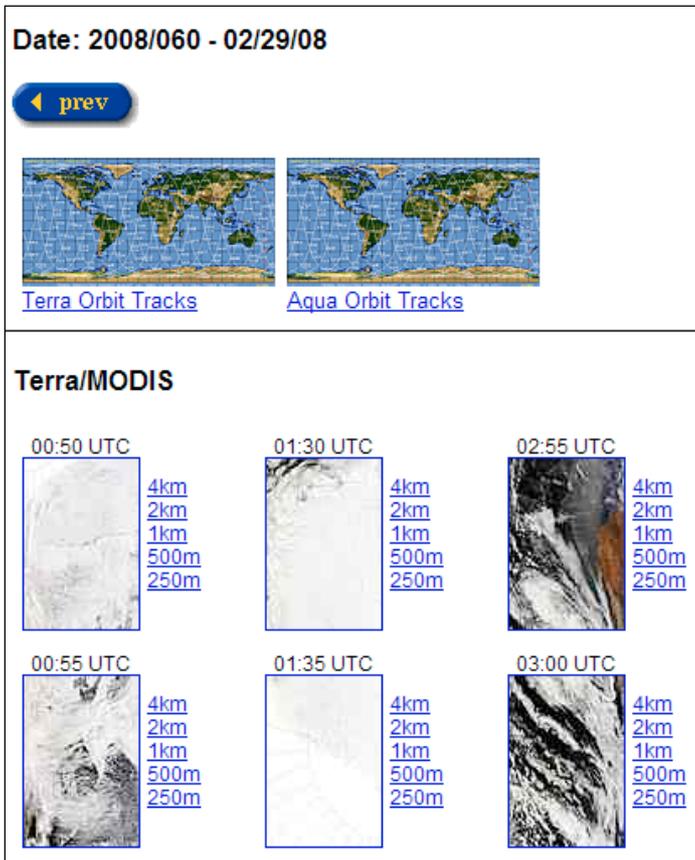

Figure 2 - Part of the Near-Real-Time Level-2 MODIS Browse page

Distortions in MODIS Images

Although the *MODIS Rapid Response Team* regularly displays a geometrically rectified 'Image of the Day', the near real-time images that you download clearly suffer by comparison. These images are displayed as scanned by MODIS, without correction for geometric distortion (a feature that will be understood by readers familiar with NOAA AVHRR imagery). In addition, they also exhibit intrusive banding towards the margins, where adjacent strips in the image overlap and display duplicated data.

MODIS builds up its images as a series of narrow strips, known as swaths, 2300 kilometres in longitude by 10 km in latitude: each image is formed by splicing many such swaths together. Immediately beneath a satellite these swaths abut together perfectly but towards the ends of each swath the fit deteriorates. This is the result of the same trick of perspective that you would observe when standing on a bridge over a railway track: the impression that the rails are becoming closer together with distance (although their spacing, of course, actually remains constant).

The same is true of each MODIS swath, where the required ground details are 'pinched together' at the extremities by the perspective effect. Consequently, unwanted additional details from the adjacent swaths become included and the image shows 'double-vision' artifacts when the swaths are

combined. Each point on the Earth's surface appears in two adjacent swaths, a phenomenon sometimes referred to as the 'bow-tie' effect.

Removing Irregularities from MODIS Images

To produce MODIS images that are as free from blemishes as possible it is necessary to

1 smooth out the 'bow-tie' artifacts, and

2 correct for geometric perspective.

Both operations can be achieved through software. The smoothing is accomplished using a program called *SmoothMODIS* which I have developed during the past year; geometric correction is achieved via the latest version of David Taylor's *CorrectGeometry* software.

A segment from a 250 m/pixel MODIS image displaying part of the coastline of Australia in the vicinity of Adelaide demonstrates how the software works. Figure 3 comes from near the right-hand edge of the original MODIS image. Though only reproduced at 25% of its original size, unwanted artifacts are evident aplenty, jagged and duplicated cloud and land boundaries in particular. Following treatment with *SmoothMODIS* (figure 4), virtually all trace of this problem has disappeared though a glance at an atlas will immediately reveal a gross distortion of the overall scene. In particular, Kangaroo Island, which is in reality more than twice as wide as it is 'high', appears almost circular! Passing the smoothed image through *CorrectGeometry* resulted in figure 5, where the features now resemble reality.

SmoothMODIS

SmoothModis is available as a setup file from

http://myweb.tiscali.co.uk/wxsatellite/software.htm

The program should be completely intuitive. Just load a MODIS image, select **<Image → Process>** from the menu bar, and observe for about 10 seconds as the image smooths in front of your very eyes. By default, *SmoothMODIS* saves smoothed images in BMP format, necessary if they are to be processed further in *CorrectGeometry*. However, if the region of interest comes from the central part of the image, and correction is not considered necessary, there is an option to save in JPEG format. SmoothMODIS only processes 250 m and 500 m MODIS images, most of which will smooth correctly by default. For dealing with the occasional 'rogue' MODIS image, a *Help* file guides you through additional program features.

CorrectGeometry

Some years ago, David Taylor produced *CorrectGeometry* to rectify geometric distortions in NOAA HRPT images. He has now upgraded this software to correct MODIS images also. You can download *CorrectGeometry* by visiting

http://www.satsignal/eu

then following the link to *HRPT Reader* under the 'Satellite Tools' section. You will find a link to download *CorrectGeometry* at the foot of this page.

Note: You must use *SmoothMODIS* before using CorrectGeometry.

Acknowledgement

All images accompanying this article courtesy of MODIS Rapid Response Project at NASA/GSFC.

References

1   Terra - http://terra.nasa.gov/About/

2   Aqua - http://aqua.nasa.gov/

3   Aura - http://aura.gsfc.nasa.gov/

4   EOS - http://eospso.gsfc.nasa.gov/

Figure 3 - Section from an **original**, uncorrected near real-time MODIS image
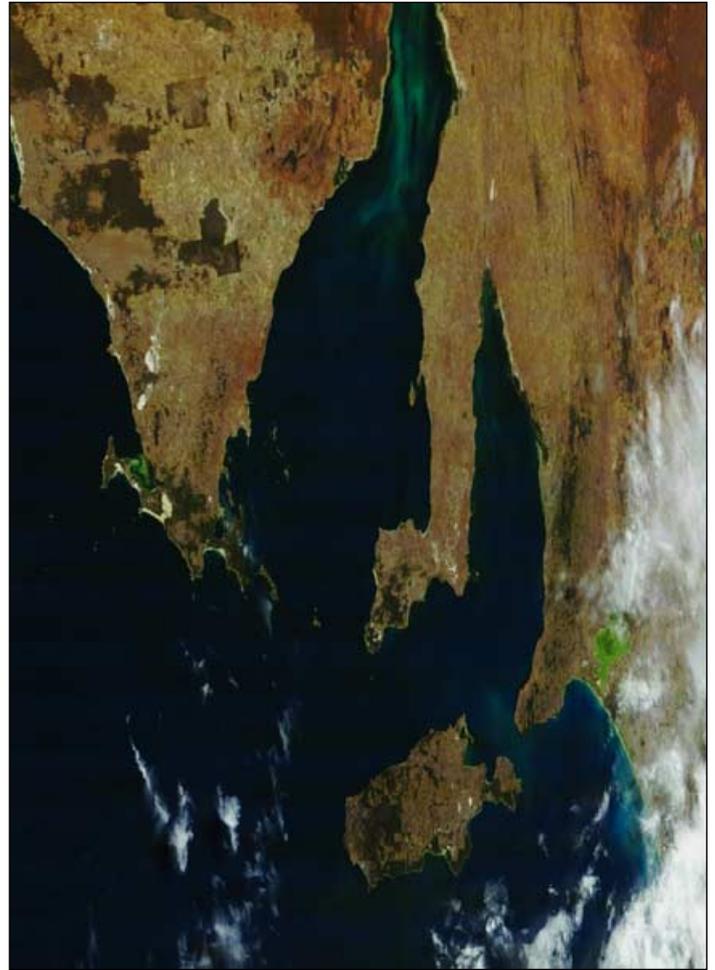
Figure 4 - The same MODIS image after use of the *SmoothMODIS* software
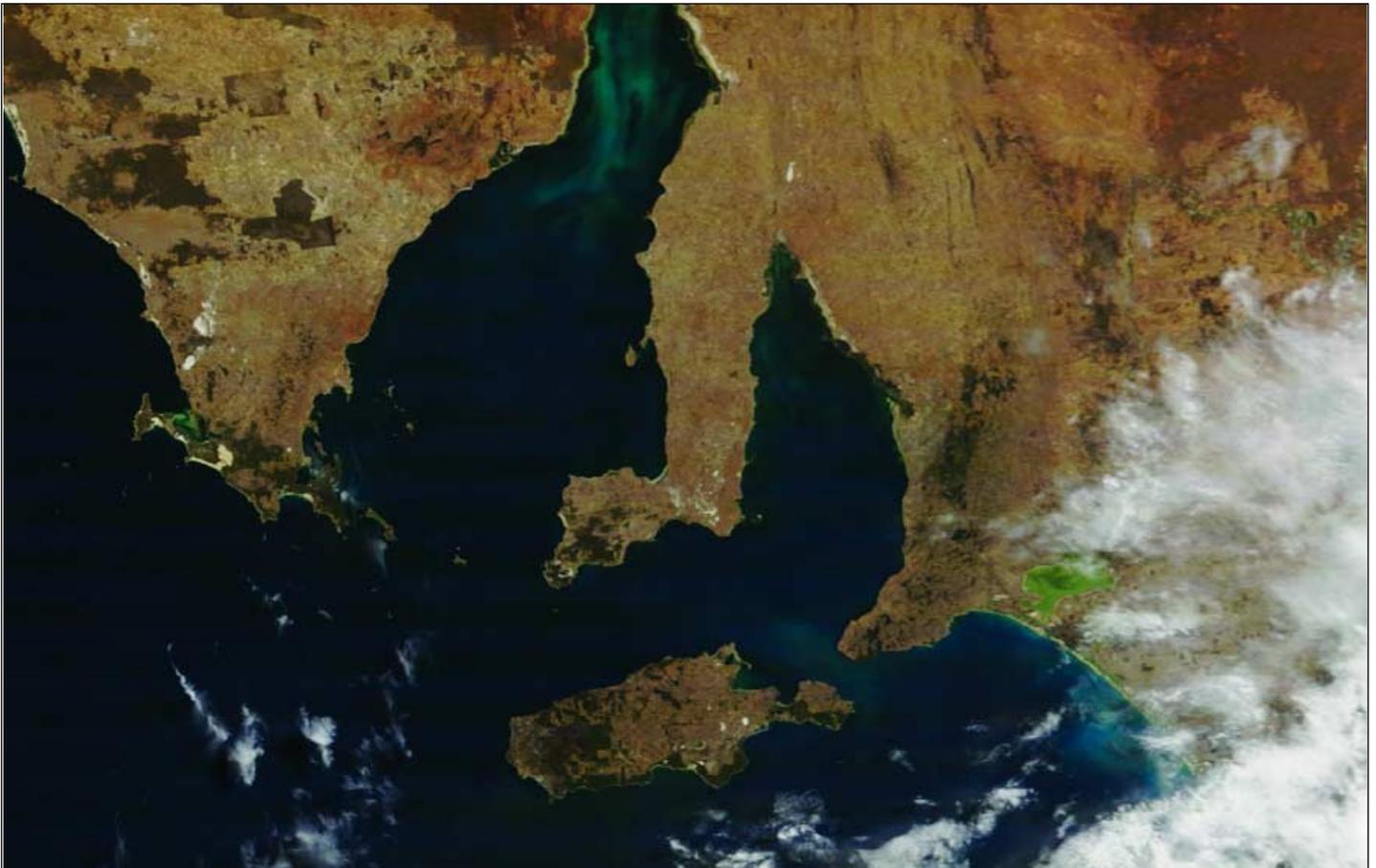
Figure 5 - The same smoothed image following geometric correction by David Taylor's *CorrectGeometry* program
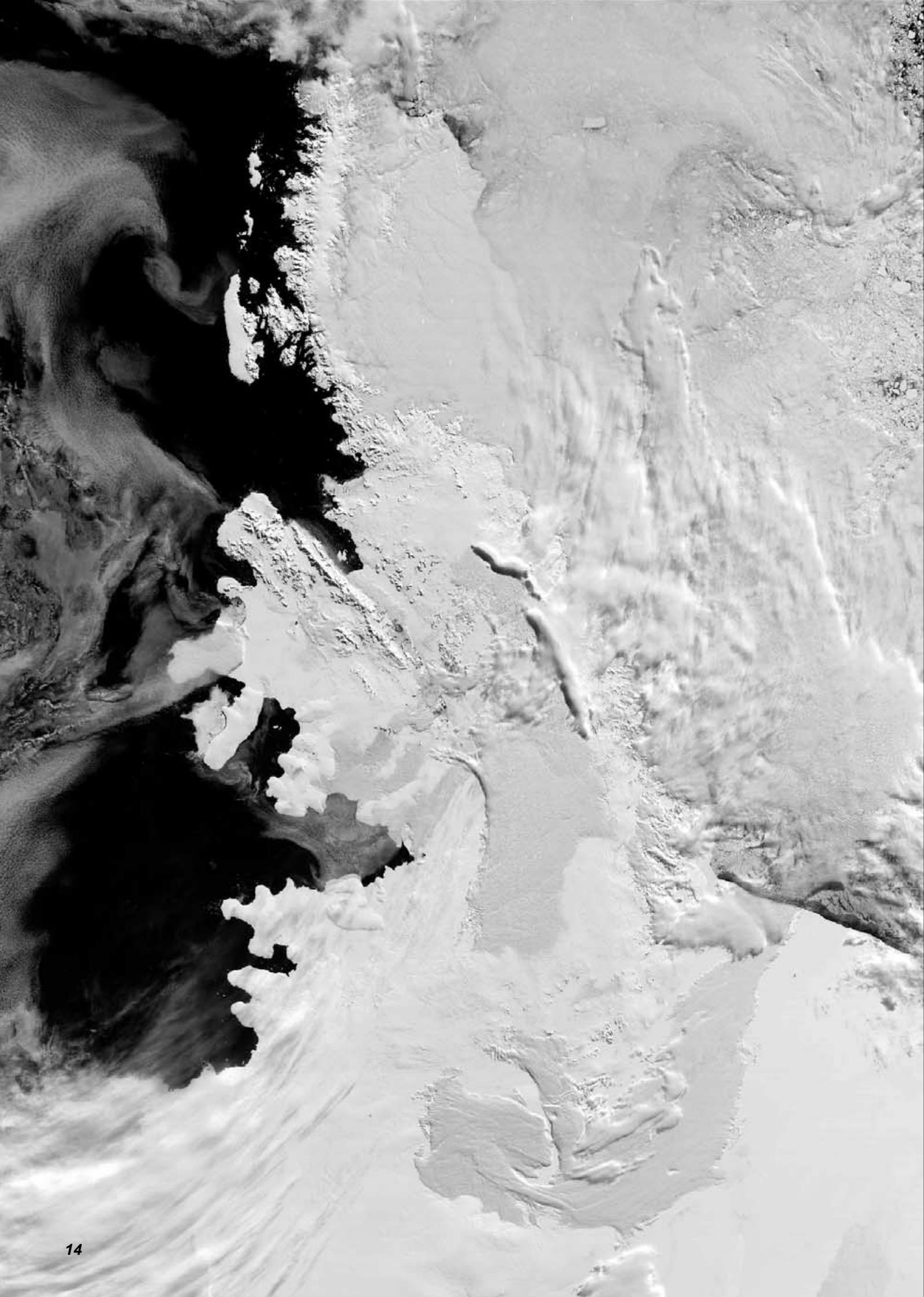
Report from the UK Space Conference
at Charterhouse School, March 27-29, 2008

General Report by Francis Bell

GEO was invited by the organisers of the *2008 UK Space Conference* to attend and provide an exhibition stand. This we did, with Francis Bell and John Tellick providing a stand demonstrating live satellite reception on all three days. Live MSG reception was displayed on two separate systems and in addition we displayed recorded APT and HRPT on two further systems. In addition we displayed boards showing examples of GEO's activities and prints of weather satellite images.

We are grateful to EUMETSAT, who sent us many technical leaflets and high quality poster sized images taken by their satellites. All this, together with GEO's own material, was available to the conference delegates and visitors and by the end of the conference, little was left!

Considering the delegate list and the organisations present, the conference certainly had a high profile. Among those in attendance were Space Science Leicester University, Surrey Satellite Technology Ltd, EDAS Astrium, British National Space Centre, Open University, UKSEDS, European Space Agency, Space Education Council. Most of these organisations visited the GEO stand during the three days.

As well as dealing with national and international space policy, the conference had a distinct educational dimension with school groups attending on different days. There was a competition for rocket launching—unfortunately not fully tested on the day because of poor weather. There was also a competition for schools to design a very small satellite, perhaps earning the opportunity to have the winning design professionally built. Several of these school groups visited the GEO stand and were given a brief presentation about our activities and the scope for home reception of weather satellites. GEO also attracted the attention of the media and we spent some time talking to and being recorded by a television team.

Overall, it was certainly interesting to meet some of those people who both influence and enact UK space activities.

Lecture Report by John Tellick

This Conference allowed GEO the opportunity to rub shoulders with both professionals in the space field and educationists. This allows us to keep up to date and promote the educational value of our hobby. I attended several of the lectures and discussions on '*Space, Policy*

and the Future' but must admit that I came away rather disheartened over what I had heard both on '*Education*' and '*The Future*'.

Ask anyone in the street what they think about the UK Space Industry and the answer you generally get is: 'What space industry?'

I grew up with Sputnik, the 'space race' and Moon landings at a time when Britain was building and launching its own rockets: with a whole industry structure of experts and capability. Those days have long gone, and yet, Britain is currently a world leader in several aspects of space technology, a fact that is just not promoted or celebrated to the public, unlike the situation in France and Germany. Many delegates seemed unhappy with this.

The International Space Station's robotic *Canadarm2* moves ESA's *Columbus* laboratory from its stowage position in Space Shuttle Atlantis' payload bay to the starboard side of the *Harmony* module.

Image: NASA

Secondly, many delegates thought that not enough money was being spent on space/science promotion or education. This is having a profound effect on the number of engineers, graduates and scientists going into the industry—our lead in several fields could be at risk. Contrast that to China and India, where vast amounts of money are being poured into space/science education. The feeling was these two countries would be the next great 'space nations.'

Space is an expensive business and one which a single country cannot go alone. With its export control restriction policy (over technology), it appears that it's getting more and more difficult for the US to co-operate internationally on space projects.

ESA astronaut Hans Schlegel works on the *Columbus* lab during the STS-122 mission
Image: NASA

There was concern over the militarisation of space as well as manned space activities beyond the ISS. There was also a big question mark over the future of ISS operations once the Space Shuttle ceases flying, currently planned for 2010.

With the recent addition of two new laboratory modules, zero gravity medical and product research aboard the ISS are about to expand considerably. But owing to the delays caused by the two Shuttle disasters though, the ISS will only be two-thirds built by 2010, after which there will be no 'space lifting capacity' available comparable with the current Shuttles. And, of course, crews have to get there and back!

A Shuttle replacement—if it ever happens—is very many years away; so, to an interested 'member of the public,' it looked to me that there were more questions than answers regarding the future of space in the west.

The Columbus Laboratory

The Columbus laboratory is ESA's biggest single contribution to the International Space Station. Inside Columbus' 4.5-metre diameter cylindrical module are 75 cubic metres of space containing an entire suite of science laboratories. These are equipped with flexible research facilities that offer extensive science capabilities where Earth-based researchers, together with the ISS crew, will be able to conduct thousands of experiments in life sciences, materials science and fluid physics in the weightlessness of orbit.

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EUMETSAT 'Satellite Images of the Month'

David Lee

I don't know if GEO Quarterly readers are already aware of the *EUMETSAT* web page '*Image of the Month*'. Visit

http://www.eumetsat.int/

and browse following **Home → Image Gallery →Satellite Images of the Month** on the top-of-page page banner (see above). This page gives access to a wide range of satellite images, and has been designed to promote *EUMETSAT* satellite images, products and services, as well as being an on-line journal for satellite imagery and a self-training tool.

Each example image carries a description of a meteorological event and an interpretation of satellite images, often with animations. I thought readers could find the educational aspect of these pages useful to their hobby. The particular example illustrated on this page relates a satellite image with photographs taken from the ground.

Date
07 September 2007
(published: 20 September 2007)
Description
High-level mountain wave clouds over the Po Valley, Italy →≡ more
⊡ Click to enter

To view the original image, browse to the 'Satellite Images of the Month' page, click the link to enter the image gallery, and browse to the thumbnail for '*07 September 2007*'.

Jochen Kerkmann, Satellite Meteorologist Training Officer, is the main organiser of these pages.

(jochen.kerkmann@eumetsat.int)

High-level Mountain Wave Clouds over the Po Valley, Italy

Descriptive text by Jochen Kerkmann (EUMETSAT)

water clouds

stau

high-level wave cloud (about -45°C)
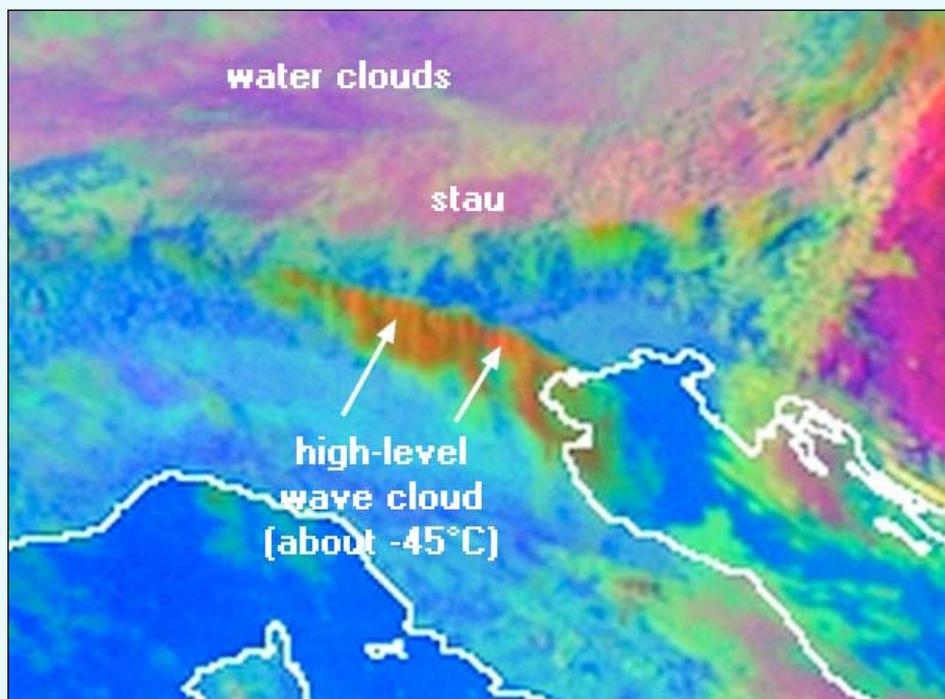
RGB composite Meteosat-9 image (Vis 3.8, IR 3.9, IR 10.8) from 15:00 UT on September 7, 2007

The images on this page show a high-level mountain wave cloud seen from both satellite (above) and the ground (below, left). As seen from both images, the wave cloud had a very sharp border on its northern (inflow) side, while the southern border was more gradual and thin. Optically, on its northern side, the cloud was thick and dark, and formed of small ice particles, as indicated by the high reflectance (about 10%) in the IR3.9 channel. This high reflectance gives the cloud an orange colour in the RGB composite when compared with the high-level ice clouds farther to the east over Croatia (which were composed from large ice particles, giving a dark red colour).

The wave cloud remained stationary over a period from about 09:00 to 16:30 UT (as can be seen from the time lapse movie available for download from the web page) then slowly dissolved in the evening hours as can be seen in the photograph below.

(Credit: J. Kerkmann).
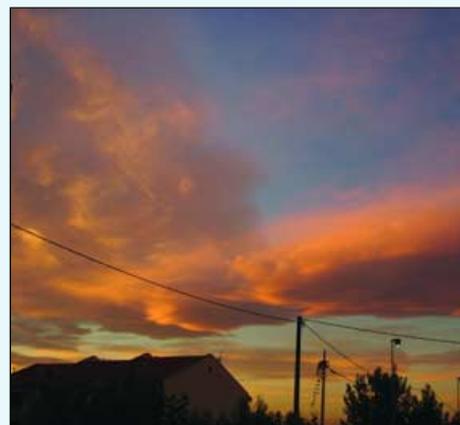
Left: View from the ground at 14:30 UT
Above: View from the ground at 17:45 UT

LRIT

(Low Resolution Image Transmission)

Part 3 – LRIT Structure and Processing

Ed Murashie - *emurashie@att.net*

The weather satellite field has become an international arena. The *Coordination Group for Meteorological Satellites* (CGMS), the informal international group that started meeting annually in 1972, has the goal of coordinating the world's meteorological systems. CGMS members include the satellite operators, such as NOAA, EUMETSAT, JMA; development agencies, such as NASA, ESA, CNES; and the *World Meteorological Organisation* (WMO). The WMO, founded in 1950, became a special agency to the United Nations in 1951.

> *'The vision of WMO is to provide world leadership in expertise and international cooperation in weather, climate, hydrology and water resources and related environmental issues and thereby contribute to the safety and well-being of people throughout the world and to the economic benefit of all nations.'*

WMO is a member of the CGMS, to ensure that the weather satellite systems meet the needs of the WMO to fulfil their goals. One of CGMS' first projects was the standardisation of WEFAX; one of its more recent projects is the standardisation of digital transmissions, including LRIT.

CGMS developed the LRIT Global Specification [1] around a model with multiple layers that describes the processing at each layer. The model is generally consistent with the *Consultative Committee for Space Data System* (CCSDS) and the *International Standards Organisation* (ISO) Open Systems Interconnect (OSI) reference model. Using the model makes LRIT very 'packetised'. At first I thought this rather complicated what had originally seemed to be an easy task—especially after working with GVAR data. Once I understood the model, and how data flows through the different organisations on its way to the satellite, it makes a little more sense.

Just remember: We are dealing with large picture and data files, each assigned a priority, splitting them into smaller segments so they can be multiplexed together then finally broadcasting them down a single radio channel. All of this happens through NOAA processing domains located at two different NOAA locations, Suitland Maryland (domains 1-4) and Wallops Island, Virginia (domain 5).

I will first describe the 7-layer model from the transmission point of view for the GOES satellite, followed by an explanation from the reception point of view. I know this sounds redundant but it makes the complicated process easier to understand, at least for me. Others may want to just read one or the other process.

The implementation of the 7-layer model varies from one satellite system to another because each country seemed to interpret the CGMS standard differently. Also, the standard leaves some aspects, like encryption, error checking and compression methods, up to the satellite operator. NOAA's interpretation can found on their website [2].

The Transmission Point of View

The *Application Layer* is the generation of the user data and can be a picture, environmental data or a text file. The *Presentation Layer* converts the data into LRIT files like the test files on the NOAA website [3]. Earth pictures are split vertically into five LRIT files, so that if any one file is lost, the whole image is not. An example of an LRIT file is

> gos11chnVS01rgnFDseg001res04dat275000630709.lrit

This is a GOES-11 visible channel, full disk image, segment (file) No.1 and N/S resolution of 4 km. It was transmitted on day 275 of the year at 00:06 UT. The LRIT file structure consists of a primary header containing the file type, total length of all headers and the data length. This primary header is followed by optional headers containing items like the file name, image structure, image navigation, time stamp, etc. The picture data follows the final header and is structured as pixels across and lines down the image. Each pixel is one byte which can represent any one of 256 shades of gray.

The *Session Layer* encrypts and compresses the data. GOES data is not encrypted but its images are compressed using a lossless proprietary *Rice compression* technique. NOAA has obtained rights to the decompression algorithm and has supplied a DLL software library for users. The initial transmission priority is assigned at the Session Layer.

The *Transport Layer* assigns 11-bit Application Process Identifier (APID) numbers, adds a transport header, and then splits the file into 1-8190 byte TP_SDUs. The APID number tells the decoding process which application this data belongs to. The transport header contains a file counter (to track lost blocks) and a file length field. The TP_SDU length is equal to the length of one compressed picture line. TP_SDU then has a 6-byte header added ahead of it and a 16-bit checksum after it to form a CP_PDU data packet. The 6-byte header contains the version, type, APID number, sequence number and packet length. The sequence number indicates whether the block is the first, continuation or last block of an LRIT file.

The sole function of the Network Layer is to convert the APID number into a virtual channel ID (VCID) number. The final CADU data packet contains only a 6-bit field, which accommodates 63 different product types, one being a dummy fill type. So LRIT can only simultaneously transmit 62 products, belonging to 62 APIDs.

The *Data Link Layer* is a busy one. It splits or packs left-over portions of CP_PDU packets into fixed 884-byte packets. A 16-bit header is added to the packet, forming an M_PDU packet. The header specifies the starting position of a new CP_PDU packet in the M_PDU packet. The Data Link layer then generates the *Reed Solomon* check characters and adds another header forming the CVCDU packet. This header contains the version number, the spacecraft ID, the VCID number and block counter. Between transmissions, fill
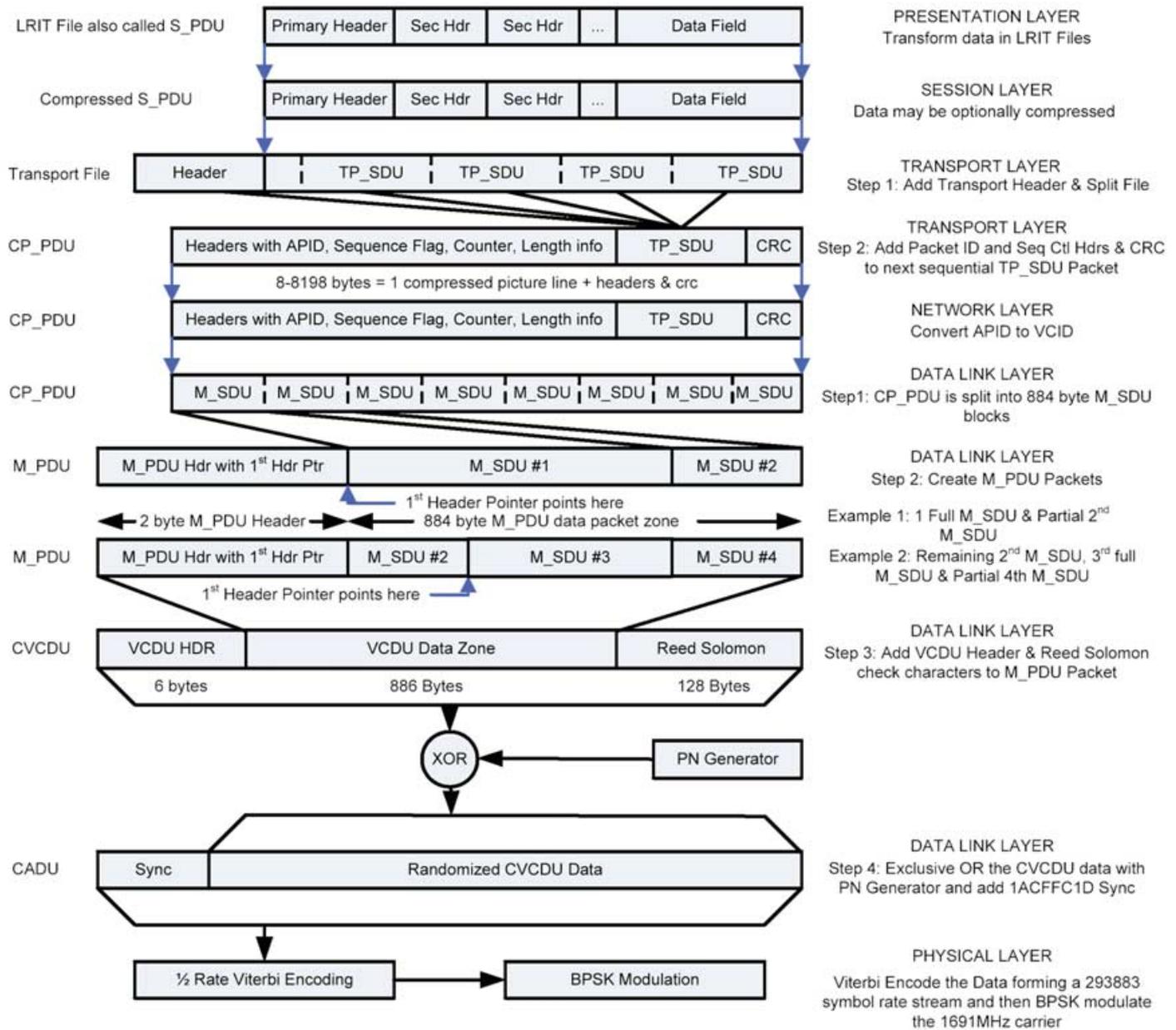
Figure 1 - The LRIT Transmission Encoding Process

CVCDU packets are transmitted with a VCID of 63. The Data Link Layer then exclusive ORs the CVCDU data with a pseudo random number (PN) sequence. The randomisation ensures that there are no long strings of 1's or 0's that would cause the receiver demodulator to drift to a DC level. Finally, the randomised CVCDU packets have a 32-bit sync pattern of '1ACFFC1D' added to the beginning of the data to help in the receiver decoding process.

The *Physical Layer* performs base to ½-rate Viterbi error encoding, adding one extra check bit for each data bit. The NRZ-L signal then Bi-Phase Shift Keys (BPSK) the 1691 MHz carrier.

The Application Layer is handled by NOAA domains 1 and 2 and the Presentation Layer is performed in NOAA processing Domain 3. Domain 4 handles the Session Layer, the Transport Layer, the Network Layer and half of the Data Link Layer. Domain 5 handles the other half of the Data Link Layer and the Physical Layer. The users are Domain 6.

The entire LRIT Transmission encoding process is shown schematically in figure 1.

The Reception Point of View

Since the *Physical Layer* involves the demodulation process and Viterbi error decoding process, the 293833 symbol per second data stream is, firstly, BPSK demodulated. Next the data stream is error decoded using the ½-rate Viterbi decoding method. This means that one error correction data bit is sent for every image data bit. More can be found about the Viterbi process on the Internet at *Wikipedia* or the many published error-correction and detection books. The output of the Physical Layer is a randomised bit stream. The *Comstream CM701* satellite modem [4], described in the last article, was chosen to implement the Physical Layer because it performs both BPSK demodulation and Viterbi decoding.

The *Data Link Layer* is composed of two sublayers; the Virtual Channel Access (VCA) layer and the Virtual Channel Link Control (VCLC) layer. The input to the VCA layer is the randomised bit-stream from the Physical Layer. The first job is to look for and extract the 32-bit block sync characters, '1ACFFC1D' hex. These sync characters signify the start of each 1024-byte CADU block. Next the VCA layer derandomises the data stream by exclusive OR-ing the CADU data with the output of a PN generator, forming a

CVCDU block. The *Xilinx* board described in the previous article implements the data Link Layer up to this point. From this point forward the Personal Computer implements the remaining layers. The next step is to perform Reed-Solomon block error correction using the 128 bytes of Reed-Solomon data on the previous 892 bytes. The Viterbi decoding process is required, but the Reed-Solomon decoding process can be skipped if there is a sufficiently high signal to noise ratio. My system uses a six foot dish and therefore the Reed-Solomon data is discarded with no perceptible noise, forming a VCDU block. The VCDU block of 892 data bytes contain a 6-byte header which contains the version number, the spacecraft ID, the virtual channel ID (VCID) and the block counter. If the virtual channel ID is 63, then the block is just a fill packet between transmissions, and the entire block can be discarded. If it is not a fill packet, the 6 header bytes are discarded forming a 886-byte M_PDU data packet which is the output of the VCA sublayer and the input to the VCLC sublayer.

You may ask what a virtual channel is. This gets back to the idea of having a flexible data format that can handle several sources of data: pictures, DCS data, etc, all at the same time by multitasking or multiplexing the data sources together. As data products are generated and ready to be transmitted, they are assigned *Application Process Identifier* (APID) numbers. The VCDU header contains 6 bits for a virtual channel ID (VCID) which is enough for 62 different products and the fill block designation. When a VCID is not being used and there is a new APID available, it is assigned the VCID number.

Now the process of demuxing the data back into LRIT files begins. VCDU data is decoded into M_PDU blocks which are decoded into a CP_PDU block and is equal to one image line. Multiple CP_PDU blocks form an LRIT file, which is 1/5 of an LRIT image.

The M_PDU header is processed to determine if there are one or more M_SDU blocks contained in the remaining M_PDU block. The header contains a pointer to the beginning of the next M_SDU block within the M_PDU block. If the header is 2047 then all of the M_PDU data belongs to a previous M_SDU block. If the header is 883 or less, then data up to the pointer is saved with the previous M_SDU block and the data starting at the pointer is saved in a new M_SDU block. One or more new M_SDU blocks may exist in the M_PDU block. Multiple M_SDUs make up a CP_PDU block and one CP_PDU block contains
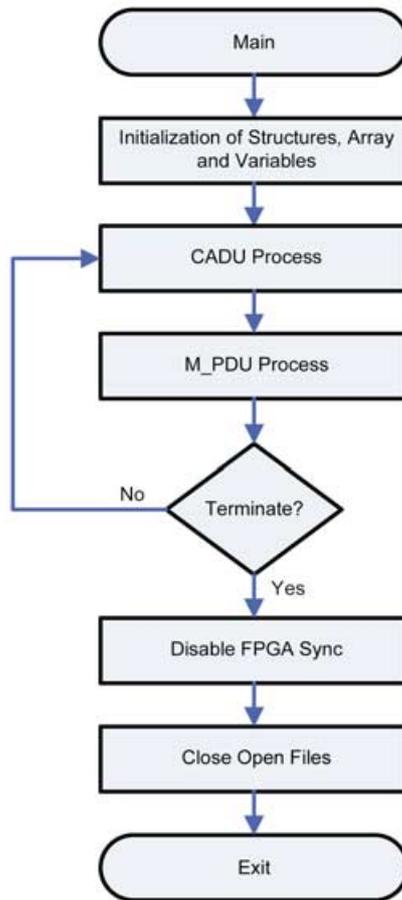
Figure 2 - Overall LRIT capture program

one image line. The CP_PDU block is the output of the Data Link Layer.

The _Network Layer_ determines which LRIT file the CP_PDU block belongs to since the data from various data sources is multiplexed. This is done by using the VCID identifier as an index into an array of open files in which the CP_PDU data is stored.

The _Transport Layer_ decodes the CP_PDU header to determine the sequence flag. If the sequence flag is '3', then the CP_PDU is one complete transport file. A transport file is a LRIT file plus a transport header. A file is opened, the CP_PDU data (minus the transport file header) is saved and the file is closed. If the sequence flag is '1',

then the CP_PDU data is the beginning of a new transport file. A file is opened and the transport header is processed. The transport header will indicate if *Rice compression* is used and if so, the data is decompressed. The decompression process is the Session Layer. The data (minus the transport header) is saved to the new file. If the sequence flag is '0', then the CP_PDU data is continuation data for a transport file. The program checks if a file has been opened, decompresses the data if required and then saves the data to the open transport file. If the sequence flag is '2', then the CP_PDU data is the last block of data for a transport file. The program checks if a file has been opened, decompresses the data if required, saves the data and closes the transport file. The output of the Session Layer is a LRIT file.

The Presentation Layer is displaying the LRIT files using my *LRITdisplay* program or *XRIT2PIC5* written by Rob Alblas [5].

NOAA provides the source code for an excellent display program, but I haven't been able to find anyone with a *Borland Builder* compiler to generate it yet (any offers?).

The LRIT Software

The source code and PC executables for the FPGA, the *LRITcapture* program and *LRITdisplay* programs are located on my website [6].

Information on the FTDI USB drivers can be found on their website [7].

The FPGA code was developed with the *Xilinx* Webpack free compiler that can be downloaded from the Xilinx website [8].

The *LRITcapture* application was written in C++ since the required *Rice* library was written in C++ and was compiled using *Microsoft Visual Studio.NET 2003*.

The *LRITdisplay* application was written in *Visual Basic. Visual Basic* was used in this instance due to its ease in manipulating graphics images. Compilation was effected using the *Microsoft Visual Basic 2005 Express*

Name	Size	Type	Date Modified
gos11chnIR04rgnUSseg001res04dat113014757017.lrit	553 KB	LRIT File	04/21/2008 6:48 PM
DCSdat113014755253.lrit	3 KB	LRIT File	04/21/2008 6:48 PM
gos11chnVS01rgnUSseg001res04dat113014800448.lrit	551 KB	LRIT File	04/21/2008 6:48 PM
DCSdat113014820539.lrit	89 KB	LRIT File	04/21/2008 6:48 PM
DCSdat113014825608.lrit	1 KB	LRIT File	04/21/2008 6:48 PM
DCSdat113014855897.lrit	1 KB	LRIT File	04/21/2008 6:49 PM
gos11chnVS01rgnUSseg002res04dat113014905111.lrit	551 KB	LRIT File	04/21/2008 6:49 PM
gos11chnWV03rgnUSseg002res08dat113014915421.lrit	142 KB	LRIT File	04/21/2008 6:49 PM
gos11chnIR04rgnUSseg002res04dat113014921475.lrit	553 KB	LRIT File	04/21/2008 6:49 PM

Figure 3 - Screenshot showing the various types of files being received out of order due to demuxing

Figure 4

The CADU block process routine
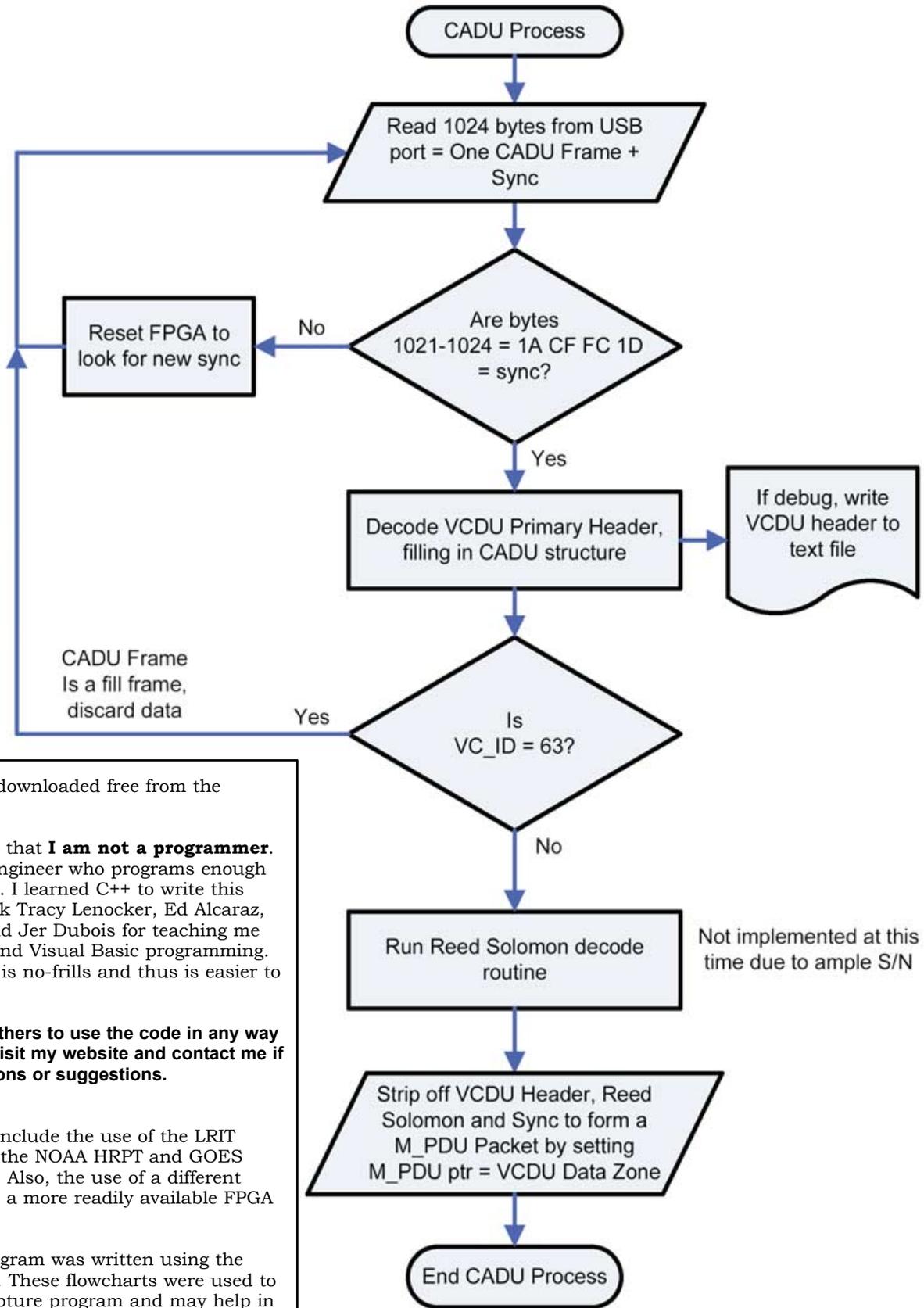
Edition that can be downloaded free from the *Microsoft* website [9].

I want to emphasise that **I am not a programmer**. I am an electronic engineer who programs enough to test my hardware. I learned C++ to write this code! I want to thank Tracy Lenocker, Ed Alcaraz, Charles Martinez and Jer Dubois for teaching me the fine art of C++ and Visual Basic programming. The code works but is no-frills and thus is easier to follow.

I highly encourage others to use the code in any way they see fit. Please visit my website and contact me if you have any questions or suggestions.

Future Articles

Future articles will include the use of the LRIT hardware to receive the NOAA HRPT and GOES GVAR data streams. Also, the use of a different satellite modem and a more readily available FPGA board.

The *LRITcapture* program was written using the following flowcharts. These flowcharts were used to develop the LRIT capture program and may help in the uinderstanding of the decoding process.

References

1 http://www.wmo.ch/pages/prog/sat/documents/CGMS-03_HRIT-LRIT_v2-6.pdf
2 http://noaasis.noaa.gov/LRIT/system_specs.htm
3 http://noaasis.noaa.gov/LRIT/testing.htm
4 The Comtech CDM-IP 300L modem has been found to work also.

5 http://www.alblas.demon.nl/wsat/software/soft_msg.html
5 http://www.alblas.demon.nl/wsat/software/soft_msg.html
6 http://home.att.net/~emurashie/
7 http://www.xilinx.com/support/download/index.htm

8 http://www.ftdichip.com/Drivers/D2XX.htm
9 http://www.microsoft.com/express/vb/

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Figure 5

The M_PDU block
process routine

M_PDU Process

Process M_PDU Header to
obtain 1st header pointer

If debug, write 1st
header pointer to
text file

Set M_PDU ptr to the start
M_PDU packet zone

A continuation M_SDU

Set it to 1 byte
larger than
M_PDU length
so all data is copied.

1st Header Pointer = 884

Yes

Is 1st Header
Pointer = 2047?

No

Copying M_PDU array from
M_PDU ptr to CP_PDU array at
CP_PDU ptr, length of
M_PDU_ptr – 1st Header pointer

Yes

Is CP_PDU
Ptr > 0?

Check if CP_PDU block
has been started

No

No CP_PDU
has been started
so discard data

A continuation
M_SDU, so exit

No

Is 1st Header
Pointer < 883?

Yes

Gsub CP_PDU Process

Either saving previous
CP_PDU, or New
CP_PDU if in a loop

CP_PDU ptr = 0
M_PDU ptr = 1st Header Pointer
M_PDU left = 488 - M_PDU ptr

Setting pointers

Copy
M_PDU array from M_PDU ptr to
CP_PDU array at CP_PDU ptr,
length of M_PDU left

Copying new data
containing new
CP_PDU w/header

Process CP_PDU Header

If debug, write
CP_PDU header
to text file

Update pointers

M_PDU ptr = M_PDU ptr +
CP_PDU len
1st Header Pointer = M_PDU ptr

Yes

Is CP_PDU_Len
< M_PDU_Left?

Determine if
There is another
CP_PDU w/header

No

If debug, write new
1st header pointer
to text file

CP_PDU ptr = CP_PDU ptr +
M_PDU_Left

Update pointers

End of M_PDU Process

Figure 6

The CP_PDU block process routine
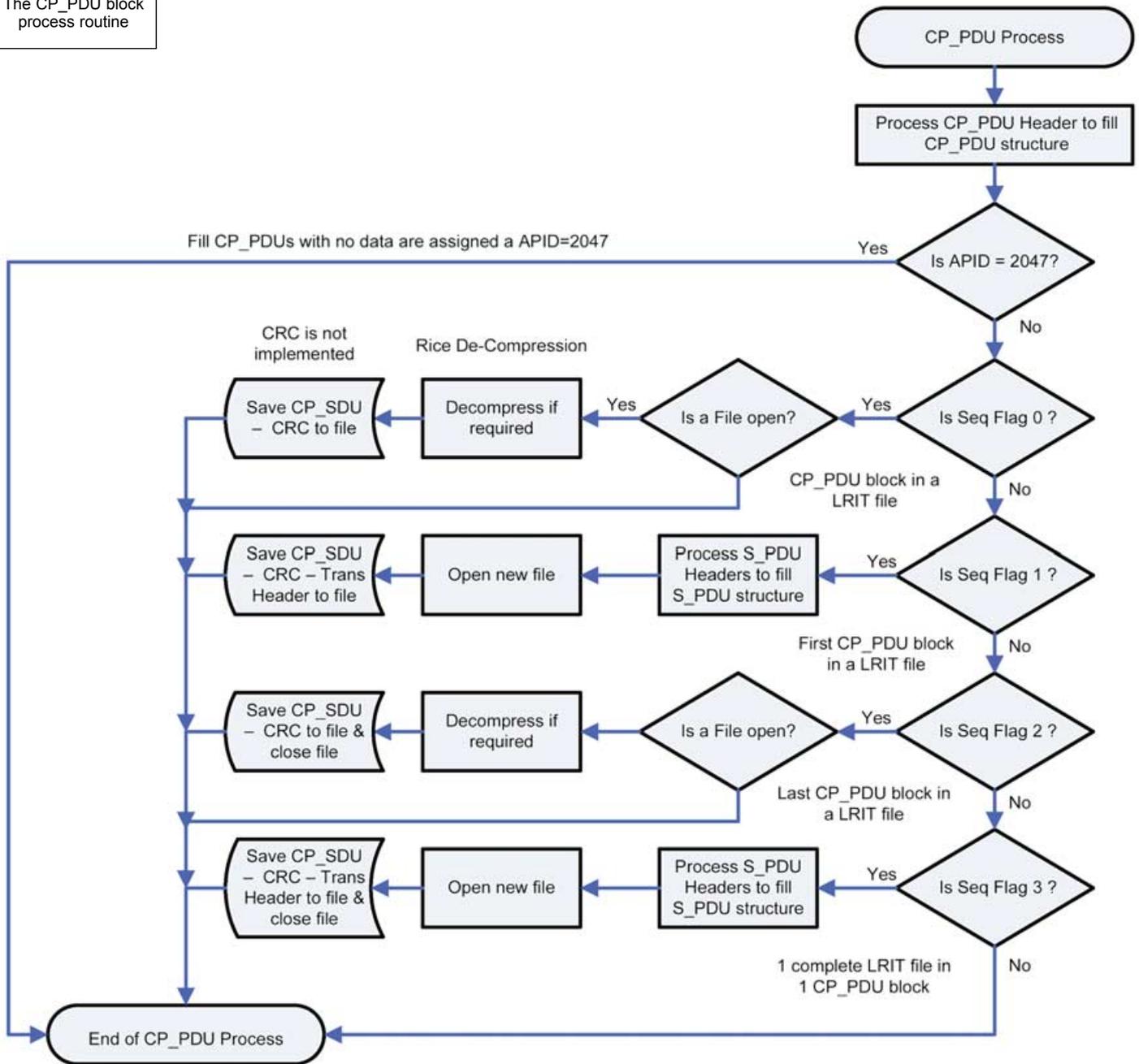
Postscript

Larry Gouliard KA9GCI and Mike Kimzey have contacted me concerning this project, and Larry and I are currently working on duplicating the LRIT system. I asked Larry to review this article, and here's what he had to say:

"I must say that I learned a lot from my reading of your article. I found your information much easier to digest than the myriad of information available on the various NOAA websites. I believe the information you presented, along with your circuitry, will allow amateur wx satellite users to duplicate your work, which provides an inexpensive method to receive LRIT. An inexpensive LRIT system has been sorely lacking in the amateur wx satellite community, especially for those of us who have been missing GOES WEFAX."

NOAA Satellite Predictions

(Based on Latitude 52°N, Longitude 2°W, UT/GMT)

	NOAA 15 137.50 MHz	NOAA 17 137.62 MHz	NOAA 18 137.10 MHz
Jun 01	05:23 07:03 15:11 16:51	09:41 11:21 19:30 21:09	01:11 02:52 11:06 12:45
Jun 02	04:59 06:39 14:48 16:27	09:18 10:58 20:46 22:26	01:00 02:41 12:34 14:16
Jun 03	04:36 06:15 16:03 17:44	10:34 12:15 20:23 22:03	02:31 04:12 12:24 14:06
Jun 04	05:52 07:32 15:39 17:20	10:11 11:52 20:00 21:39	02:20 04:01 12:14 13:55
Jun 05	05:28 07:08 15:16 16:55	09:48 11:28 19:37 21:16	02:10 03:51 12:03 13:44
Jun 06	05:04 06:44 14:53 16:31	09:25 11:05 20:53 22:34	01:59 03:40 11:53 13:34
Jun 07	04:40 06:20 16:07 17:49	10:42 12:22 20:30 22:10	01:49 03:30 11:43 13:23
Jun 08	05:56 07:36 15:44 17:24	10:19 11:59 20:07 21:47	01:38 03:19 11:32 13:12
Jun 09	05:32 07:12 15:20 17:00	09:56 11:36 19:44 21:23	01:28 03:09 11:22 13:02
Jun 10	05:08 06:48 14:57 16:36	09:32 11:12 21:00 22:42	01:17 02:58 11:12 12:51
Jun 11	04:44 06:24 14:34 16:12	09:09 10:49 20:37 22:18	01:07 02:48 12:41 14:23
Jun 12	04:21 06:00 15:48 17:29	10:26 12:06 20:14 21:54	00:57 02:37 12:31 14:12
Jun 13	05:37 07:17 15:25 17:04	10:03 11:43 19:52 21:31	02:27 04:08 12:20 14:02
Jun 14	05:13 06:53 15:01 16:40	09:40 11:20 19:29 21:08	02:16 03:57 12:10 13:51
Jun 15	04:49 06:29 14:38 16:16	09:17 10:57 20:44 22:25	02:06 03:47 11:59 13:40
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Jun 17	05:41 07:21 15:29 17:09	10:10 11:50 19:59 21:38	01:45 03:26 11:39 13:19
Jun 18	05:17 06:57 15:05 16:45	09:47 11:27 19:36 21:15	01:35 03:15 11:29 13:09
Jun 19	04:53 06:33 14:42 16:21	09:24 11:04 20:52 22:34	01:24 03:05 11:19 12:58
Jun 20	04:29 06:09 15:57 17:38	10:41 12:21 20:29 22:09	01:14 02:54 11:08 12:48
Jun 21	05:45 07:26 15:33 17:13	10:18 11:58 20:06 21:46	01:03 02:44 12:37 14:19
Jun 22	05:21 07:02 15:10 16:49	09:54 11:35 19:43 21:22	02:33 04:15 12:27 14:08
Jun 23	04:58 06:38 14:46 16:25	09:31 11:11 20:59 22:41	02:23 04:04 12:16 13:58
Jun 24	04:34 06:14 16:01 17:42	09:08 10:48 20:36 22:17	02:13 03:54 12:06 13:47
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Jun 27	05:02 06:42 14:51 16:30	09:39 11:19 19:28 21:06	01:41 03:22 11:35 13:15
Jun 28	04:38 06:18 16:06 17:47	09:16 10:55 20:43 22:24	01:31 03:12 11:25 13:05
Jun 29	05:54 07:34 15:42 17:22	10:32 12:13 20:20 22:01	01:20 03:01 11:15 12:54
Jun 30	05:30 07:10 15:18 16:58	10:09 11:49 19:58 21:37	01:10 02:51 12:44 14:26
Jul 01	05:06 06:46 14:55 16:34	09:46 11:26 19:35 21:14	00:59 02:40 12:33 14:15
Jul 02	04:43 06:23 14:32 16:10	09:23 11:03 20:51 22:32	02:30 04:11 12:23 14:04
Jul 03	04:19 05:59 15:46 17:27	10:40 12:20 20:28 22:08	02:19 04:00 12:12 13:54
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Jul 13	05:20 07:00 15:08 16:47	10:08 11:48 19:57 21:36	02:15 03:56 12:09 13:50
Jul 14	04:56 06:36 14:45 16:23	09:45 11:25 19:34 21:13	02:05 03:46 11:58 13:39
Jul 15	04:32 06:12 15:59 17:41	09:22 11:02 20:50 22:31	01:54 03:35 11:48 13:28
Jul 16	05:48 07:28 15:36 17:16	10:38 12:19 20:27 22:07	01:44 03:25 11:38 13:18
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Jul 27	04:45 06:25 14:34 16:13	09:44 11:24 19:33 21:11	01:30 03:11 11:24 13:03
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Jul 29	05:37 07:18 15:25 17:05	10:37 12:18 20:25 22:06	01:09 02:50 12:43 14:25
Jul 30	05:13 06:54 15:02 16:41	10:14 11:54 20:03 21:42	00:58 02:39 12:32 14:14
Jul 31	04:50 06:30 14:39 16:17	09:51 11:31 19:40 21:19	02:29 04:10 12:22 14:03
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Sep 23	04:59 06:39 14:48 16:27	10:40 12:20 20:28 22:09	01:27 03:08 11:21 13:01
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Sep 26	05:27 07:08 15:15 16:55	09:31 11:11 19:20 20:58	00:56 02:36 12:29 14:11
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Sep 28	04:40 06:20 14:29 16:07	10:24 12:05 20:12 21:52	02:15 03:56 12:09 13:50
Sep 29	04:16 05:56 15:43 17:24	10:01 11:41 19:50 21:29	02:05 03:46 11:58 13:39
Sep 30	05:32 07:12 15:20 17:00	09:38 11:18 19:27 21:06	01:54 03:35 11:48 13:28

GEO Helplines

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London, ENGLAND
Specifically, help for APT users (137 MHz band).
- e-mail: geo@koholland.plus.com

David Strickland
Truro, Cornwall, ENGLAND
David has set up his own wireless network system of three computers. He has interests in electronic design and prototyping, general computing, microchip processors with various facilities and of course MSG satellite imaging. He will be happy to discuss any of the above topics, and to help anyone local, including viewing his setup.
- e-mail: David@Strickland.uk.com

Geoff Morris GW3ATZ
Shotton, Flintshire, NE WALES
Geoff has lots of experience with aerial, co-ax,connectors, mounting hardware etc. and has also done a lot of work with the orbiting satellites. Geoff has been a EUMETCast Meteosat-8 user for some time and is familiar with David Taylor's MSG software; he should be able to share his experiences with newcomers to this branch of the hobby.
- Tel: (01244) 818252
- e-mail: gw3atz@btopenworld.com

Guy Martin G8NFU
Biggin Hill NW Kent, ENGLAND
Guy is prepared to advise anyone who wishes to receive MSG under Windows 2000.
- agm@tonbridge-school.org

Hector Cintron
San Juan, Puerto Rico, USA
Hector is prepared to field enquiries on HRPT, APT, EMWIN and NOAAPORT.
- Phone: 787-774-8657
- e-mail: n1tkk@hwic.net

Email contact can of course be made at any time, but we would ask you to respect privacy by restritricting telephone contact to the period 7.00-9.00 pm in the evenings.

Internet News/Discussion Groups

There are a numerous Internet-based discussion groups available to weather satellite enthusiasts. You can join any of these by sending an e-mail to the appropriate address, with a request to subscribe. Indeed, a blank e-mail containing the word 'subscribe' in its Subject line is all that is required. Some of the more useful groups and their contact addresses are listed below.

APT Decoder
This is a group where users of Patrik Tast's APTDecoder can share information and problems.
http://tech.groups.yahoo.com/ group/APTDecoder/

GEO-Subscribers
This is a group where GEO members can exchange information relating to either GEO itself or Earth observation satellites and related matters.
http://tech.groups.yahoo.com/ group/GEO-Subscribers/

Satsignal
An end-user self help group for users of David Taylor's Satellite Software Tools (SatSignal, WXtrack, GeoSatSignal, HRPT Reader, GroundMap, MSG Data Manager, AVHRR Manager and the ATOVS Reader.
http://tech.groups.yahoo.com/group/SatSignal/

MSG-1
A forum dedicated to Meteosat Second Generation (MSG), where members share information about the *EUMETCast* reception hardware and software.
http://tech.groups.yahoo.com/group/MSG-1/

METOP
A forum for users of high-resolution AHRPT data from the MetOp satellite, available via *EUMETCast*.
http://tech.groups.yahoo.com/group/METOP/

AVHRR
A forum for users who download high-resolution EARS-AVHRR data from the NOAA polar orbiting weather satellites via *EUMETCast*.
http://tech.groups.yahoo.com/group/AVHRR/

ATOVS
A Group for discussions about using ATVOS data. Data from the whole world is available from CLASS (www.class.noaa.gov) and for an extended Europe, via *EUMETCast*.
http://tech.groups.yahoo.com/group/ATOVS/

Weather Satellite Reports
A group providing reports, updates and news on operational aspects of weather satellites.
http://tech.groups.yahoo.com/ group/weather-satellite-reports/

WXtoImg
Users of the WXtoImg software package for capturing and imaging NOAA APT can air their problems, discuss its features and ask questions about it.
http://groups.yahoo.com/group/wxtoimg-l/

Websites

Meteokit
This is a powerful and effective tool, made available to all meteorology amateurs, who require to download large quantities of meteorological maps from various sites, and to automatically compare, catalogue and sort them, according to various criteria.
The program deals with both downloading and immediate, automatic cataloguing of the maps; maps are 'smartly' downloaded and immediately made available for display, and compared based on their different parameters
http://www.meteokit.com/app/en/index.php

MODIS Real-Time Earth Images
Recent high-resolution imagery from NASA's Terra and Aqua satellites is posted here. There is also a gallery of near real-time current images.
http://rapidfire.sci.gsfc.nasa.gov/gallery/

Cloud Structures
Protographs from orbit, with explanations, of many cloud structures: convective cells, vortexes, cyclones, cloud arcs, gravity waves .... and more.
http://www.brockmann-consult.de/CloudStructures/

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Earth Imaging News

Peter Wakelin

Earth Imaged from Moon Orbit

An image of Earth taken by the high-definition TV camera on board the Japanese spacecraft *Kaguya* whilst on its way to the moon appeared in the December, 2007 issue of *GEO Quarterly*. Now, in a rare alignment opportunity, it has imaged Earth again from its low (100 km) orbit around the moon. The HDTV camera, specially developed for space use by NHK, the Japan Broadcasting Corporation, captured the image below, on April 6, when the moon was about 380,000 km from Earth. NHK processed the image for JAXA, the Japan Aerospace Exploration Agency.

Earth imaged from the Moon
Image: © JAXA/NHK

Wilkins Ice Shelf Disintegrates

Satellite imagery from the *National Snow and Ice Data Center* at the University of Colorado at Boulder reveals that the 13,680 square kilometre Wilkins ice shelf on the southwest of the Antarctic Peninsula began to disintegrate on February 28 when a 41 × 2.5 km iceberg fell away from the ice shelf's southwestern front, triggering a runaway disintegration of 405 square kilometres of the interior. A narrow beam of intact ice, just 6 km wide, was protecting the remaining shelf from further breakup as of March 23.

As ice shelves are floating, their disintegration and melting does not cause any direct rise in sea level although many such shelves hold back glaciers which, if unleashed, would contribute to the rise in global sea levels.

Several other ice shelves in this region have collapsed in the last thirty years, the most spectacular of which was
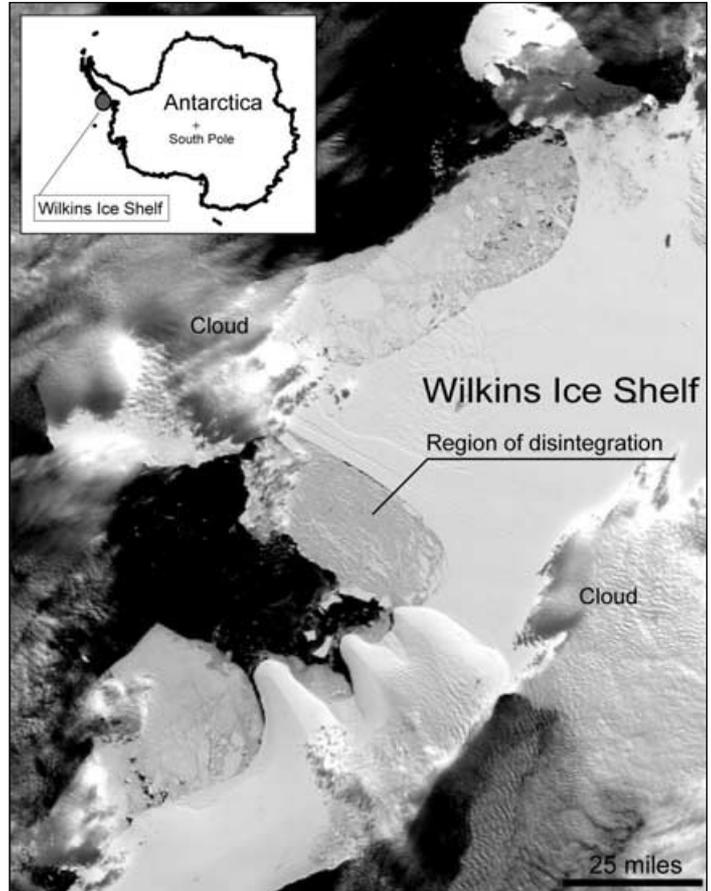

Wilkins Ice Shelf, Antarctica
Image: NASA/GSFC

Larsen-B in 2002, which disappeared in the space of five weeks. The Prince Gustav Channel, Larsen Inlet, Larsen-A, Wordie, Muller and the Jones Ice Shelf collapses also underscore the marked, recent warming in this region of Antarctica.

NPP Delayed Again

A contractor's slow development of a critical new sensor for the precursor mission for the *National Polar-Orbiting Environmental Satellite System* (NPOESS) has further delayed the launch of the *NPOESS Preparatory Project* (NPP). The sensor involved is the Visible Infrared Imager Radiometer Suite (VIIRS), a new high-performance imager for the next-generation NOAA polar-orbiting weather satellites.


Artist's impression of NPP
Image: NASA

It was in May, 1994 that a US Presidential Decision directed the US Departments of Commerce and Defense to converge their separate polar-orbiting environmental satellite programmes into a single entity to serve both military and civilian needs. The outcome of discussions was that

NPOESS and the first spacecraft was expected to be available for launch 'toward the middle to latter half of the next decade'. As the projected launch date slipped and it was thought possible that the remaining current generation of polar-orbiters would not last until NPOESS was operational, the NPOESS Preparatory Project was born with an anticipated launch date of October, 2006. The NASA launch schedule now (late April) gives June 2010 as the launch date for NPP and the first NPOESS craft is not expected to be launched before 2013.

Envisat Observes Regionally Elevated CO_2 from Man-made Emissions

Scientists at the Institute of Environmental Physics (IUP) at the University of Bremen in Germany, using data from the *SCIAMACHY* instrument on ESA's environmental satellite, *Envisat*, have, for the first time, detected regionally elevated atmospheric carbon dioxide levels originating from man-made emissions.
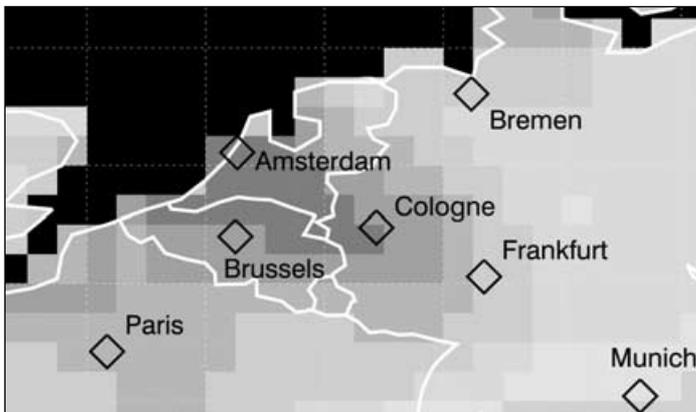
Regionally elevated carbon dioxide (CO2) levels
Image: IUP, DLR and ESA

Dr Michael Buchwitz and his colleagues used *SCIAMACHY* data from 2003 to 2005 to detect the relatively weak atmospheric CO_2 signal arising from man-made emissions and found a plume of elevated CO_2 levels extending from Frankfurt, Germany to Amsterdam in the Netherlands, as shown by the darker shades in the diagram.

'The natural CO_2 fluxes between the atmosphere and the Earth's surface are typically much larger than the CO_2 fluxes arising from man-made CO_2 emissions, making the detection of regional anthropogenic CO_2 emission signals quite difficult,' Dr Buchwitz explained. 'This does not mean, however, that the anthropogenic fluxes are of minor importance. In fact, the opposite is true because the man-made fluxes are only going in one direction whereas the natural fluxes operate in both directions, taking up CO_2 when plants grow but releasing it again later when the plants decay. This results in higher atmospheric CO_2 concentrations in the first half of the year followed by lower CO_2 during the second half of the year with a minimum around August. That we are able to detect regionally elevated CO_2 over Europe shows the high quality of the SCIAMACHY CO_2 measurements.'

More details on this, and useful weblinks, can be found at:

**http://www.esa.int/esaCP/SEMZHVM5NDF_index_1.html**

NASA Extends Cassini's Grand Tour of Saturn

More than 10 years following launch and four years after entering orbit around the ringed planet, Saturn, the *Cassini* spacecraft is in good health and still has sufficient propellant remaining for several more years of operation. Due to end in July, 2008, NASA has extended the international Cassini-Huygens mission by two years.

The two-year extension will include 60 additional orbits of Saturn and more flybys of its exotic moons. These will include 26 flybys of Titan, seven of Enceladus and one each of Dione, Rhea and Helene. The high priority given to Enceladus stems from earlier findings from *Cassini* that lead scientists to think that liquid water may lie just beneath the surface of this tiny moon. Geysers of water-ice have been observed jetting from the surface of Enceladus and, because of the moon's weak gravity, they feed particles into Saturn's ring system. The largest moon, Titan has many similarities to Earth and may now be similar to what Earth was like before life evolved.

Massive Iceberg Breakup Observed

The huge A53A iceberg broke off the Larsen Ice Shelf, on the eastern side of the Antarctic Peninsula, in April, 2005 and has now broken up after reaching the warmer waters east of the island of South Georgia in the South Atlantic Ocean.
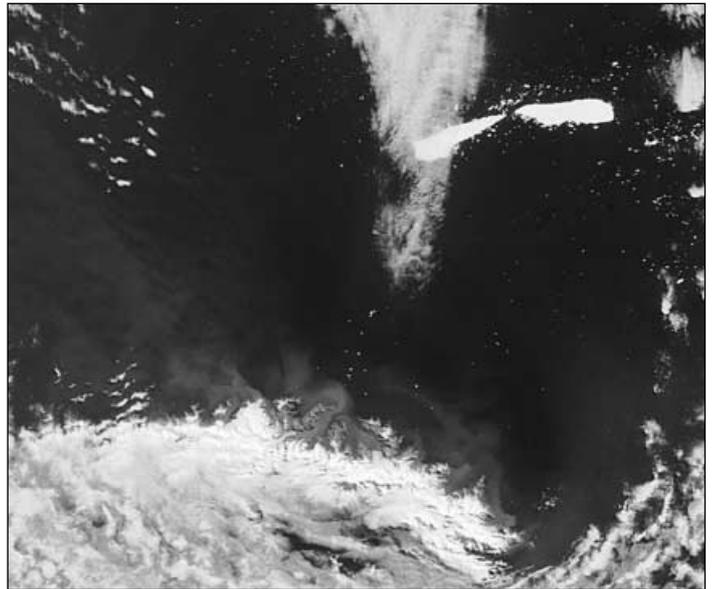
Iceberg A-53A following breakup in the South Atlantic ocean
Image: C-CORE, ESA

A huge north-south fissure through the 'berg was spotted on March 1 by *C-CORE,* the Canadian ice-tracking service, while studying satellite images collected from the Advanced Synthetic Aperture Radar onboard *Envisat.* This indicated that the 'berg was likely to split and, just three days later, the Medium Resolution Imaging Spectrometer (MERIS) on *Envisat* captured this image confirming the breakup. Parts of South Georgia are free of cloud and can be seen at the bottom of the image.

SAR-Lupe 4 Launched

Germany's fourth *SAR-Lupe* radar satellite was launched by a Russian Kosmos-3M vehicle from the northern cosmodrome at Plesetsk, Russia on March 27 into a sun-synchronous near-circular orbit. Like the three previous ones launched since December, 2006, this satellite orbits just below 500 km altitude. The fifth and final *SAR-Lupe* is scheduled for launch later this year. 'Lupe' is the German word for magnifying lens.

The X-band synthetic aperture radar (SAR) has a 3 m diameter antenna and is capable of resolving targets to better than one metre. The satellites were developed by the German aeronautics company OHB-System but the cores of the SAR sensors were provided by Thales Alenia Space. Spacecraft control and data retrieval and analysis are carried out at the ground station at the Zentrum für Nachrichtenwesen der Bundeswehr in Gelsdorf, Germany.

Interference to APT Satellite Reception

Alan Sewards

Ten years ago, Alan Sewards compiled a seminal article detailing the various sources of interference that frequently bedevilled APT and Wefax weather satellite images. For many years, Alan's article appeared on the EUMETSAT website. As ever more hobbyists take up APT imaging for the first time and queries about interference appear on weather satellite Internet Forums, Alan has kindly updated his article for GEO readers.

Introduction

You have splashed out for that 137MHz wxsat receiver, software and some sort of aerial, hooked them all together, and waited for the first pass of one of the NOAA weather satellites. When it appears, you are very excited at the thought that you have picked up a remote sensing signal from a spacecraft, in real time, and are actually seeing the surface of the Earth.

After a while, you will very likely notice that the images you receive are impaired in one way or another. If you have bought the various parts of your system from well-known vendors, it is unlikely that there will be anything wrong with the receiving chain; the cause of the impairments is most likely to be interference.

Interference can arise from three main sources

- transmissions on or near the spacecraft frequency from terrestrial or space sources,
- emissions from your computer system,
- power line interference.

This article is aimed at explaining the sources of the various interference, showing how to recognise them, and suggesting ways of mitigating or eliminating the effects.

Things have moved on since this article first appeared 10 years ago and I felt that an update would be useful. In some ways the update is premature, as APT is giving way to new digital formats (HRIT and LRIT), but as there are still weather satellites using the APT signal format, there will be users who will find the article useful. LRIT in particular has not made much impression on the receiving market as few affordable systems have appeared. For myself, I have embraced the excellent EUMETCast service, which has provided me with huge amounts of superb data, with no worries about interference!

Causes of Interference

Pagers

Interference from terrestrial transmissions was rare until the late 1990s, when the craze for pagers took off and the countryside became liberally sprinkled with high power transmitters operating within a few megahertz of the frequencies used by the NOAA Tiros-type satellites for their APT signals. These transmitters have effective radiated powers of 10 - 50 watts, and may be located in your neighbourhood. In my case, there were two transmitters situated at 500 and 800 metres distance respectively, with ERPs of 30 W and 120 W. Although these transmissions are on lawfully allotted frequencies and the bandwidth and power are (supposed to be) strictly controlled, they are close enough in frequency to the satellite signal for the RF selectivity of the weather satellite (wxsat) receiver to experience problems. If the pager signal is strong enough it overloads the RF stages or the mixer of the receiver and breakthrough of the pager signal on to the satellite frequency to which the receiver is tuned. Those wxsat APT receivers designed
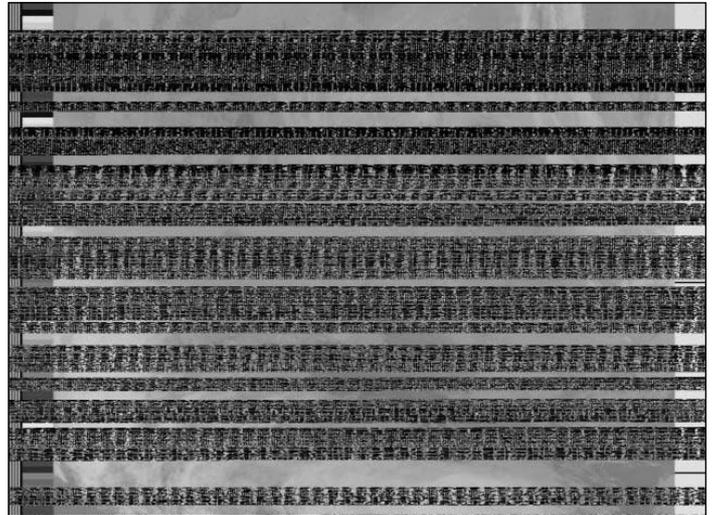

Figure 1 - Typical pager interference
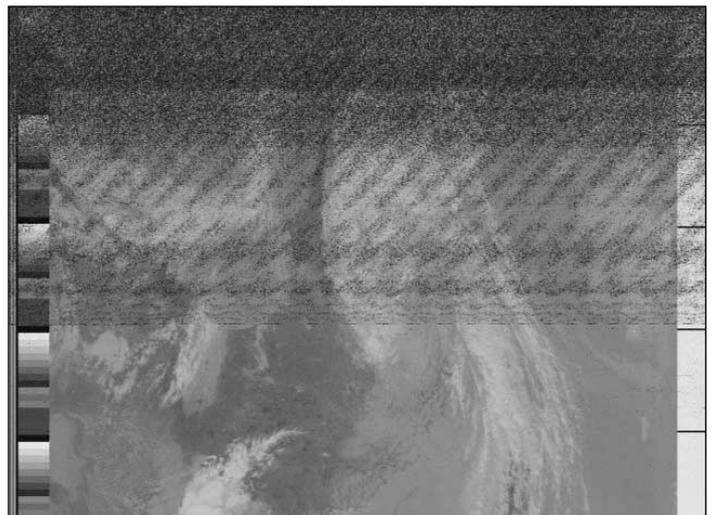

Figure 2 - CRT monitor interference
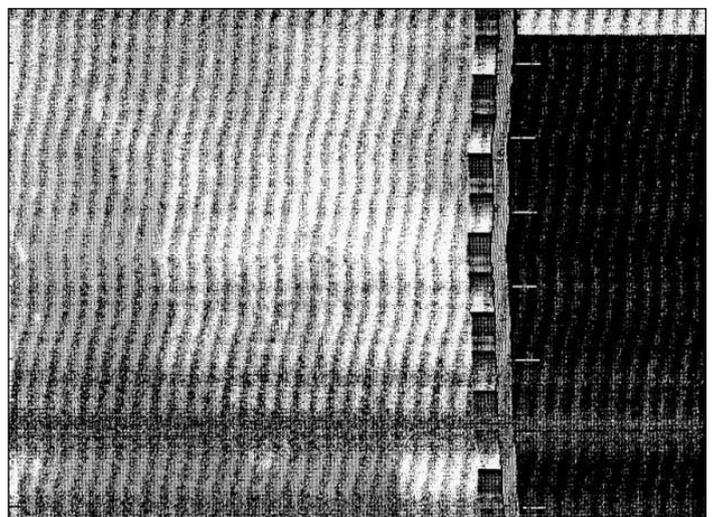
Figure 3 - Power line interference

before the pager revolution tend not to have adequate RF selectivity and ability to handle strong interfering signals: more recent designs are much better in this respect.

Computers

Computers can produce interference in several ways. Most obvious is the general hash produced by all the fast edges of the clocks and other waveforms in the computer. This is often very bad in the shortwave frequency band. Stable signals from the master clocks of the CPU and the bus, and their harmonics, can also be found. However, for many people these do not seem to cause significant problems with APT reception, probably because the hash is fairly well attenuated by the time we get to 137 MHz, and the harmonics of the clocks do not fall on the frequencies of interest. Others, however, do experience strong interference, and sometimes resort to recording the satellite audio on a tape recorder and turning the computer off. 14400 bps modems have a strange quirk in that most of them seem to generate a strong signal on 137.62 MHz, the NOAA-17 APT frequency, but such modems are rare these days. The other major culprit is the CRT monitor, which can radiate strong RF interference over a wide band, modulated at the refresh rate, even though it may be labelled 'low emission'. In these days of flat screen LCD monitors, this problem will likely be going away.

Power Lines

Power line interference is often a mystery, as it comes and goes in a seemingly random manner and its source may be quite distant. In general, it is caused by a poor contact somewhere on an outdoor overhead power line. The contact may be intentional, such as two cables spliced together, or unintentional, such as a piece of wire like a coat hanger hooked over the line. High voltage insulators can produce corona discharges under certain conditions, such as dirt on them or dampness. The poor contact causes arcing, which generates the RF spectrum, which is modulated at 50 or 60 Hz depending on which continent you live in. Winds, rain, fog and snow can all have an effect on power line interference, sometimes increasing it dramatically and at other times reducing it, depending on the type of faulty connection. One feature of certain types of power line interference is that it tends to build up slowly over a period of months or longer as an insulator or joint on a line degrades. Power line interference on an APT image is very similar in appearance to the interference caused by a computer monitor.

Co-channel Interference from another Satellite

There are two types of co-channel interference, that seen on GOES WEFAX and Meteosat signals is the result of using a receiving antenna with too wide a beamwidth or excessively high side-lobes. Such an antenna receives not only the signal from the desired satellite (say, GOES 10), but also the signal from another satellite located at a different longitude. As all GOES and (I believe) Meteosat geostationary weather satellites radiate on 1691 MHz, this results in a beat pattern on the images, often called herringbone interference. This effect could also occur with the NOAA TIROS satellites, except that the *Spacecraft Control Center* takes care to turn off the transmitter of one of the satellites if their orbits coincide. Co-channel interference from terrestrial transmitters is rare, because of frequency allocation regulations. More recently another source of co-channel interference has appeared, with the deployment of the *Orbcomm* satellite constellations. These digital data communications satellites are also in low-earth orbits (LEO) but not in the same planes as the polar orbiting NOAA and METOP satellites. But their frequency allocations are in the 137 MHz band and the frequencies used are very close, so interference is occasionally experienced.

Illustrated Interference Examples

Figure1 shows a typical case of pager interference. It is characterised by bars of interference lasting tens of seconds, and within the bar can be seen blank periods and periods with dotted lines. These correspond to the tones, intervals and data (and sometimes voice) of the pager burst. Like most interference, pagers have worse effects at low angles of elevation of the satellite where the signal is weakest, so they are usually seen at the beginning and end of passes. Because the interference is the
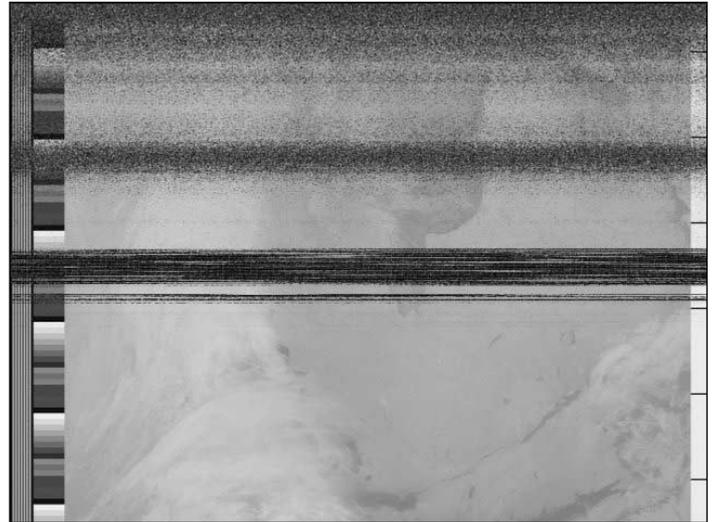

Figure 4 - Antenna problem
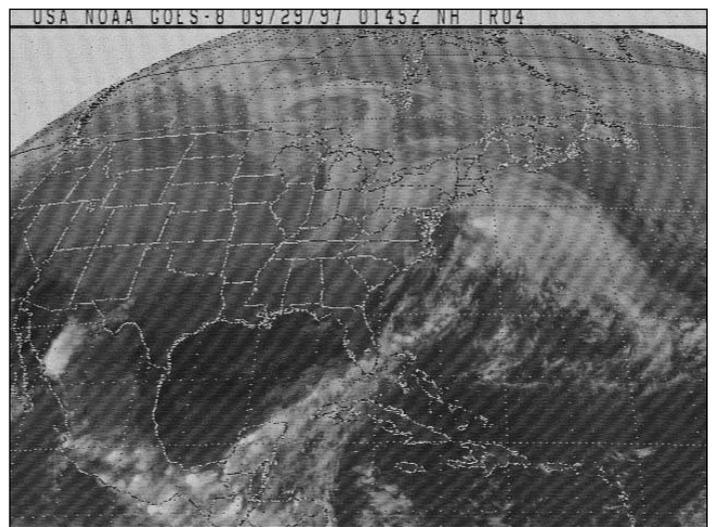

Figure 5 - GOES Co-channel interference
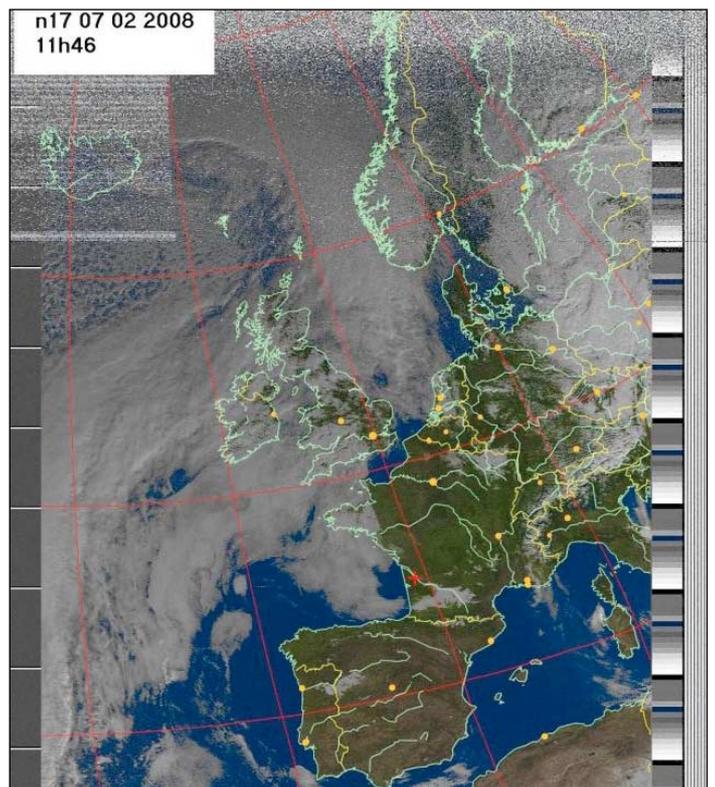
Figure 6 - Orbcomm satellite interference

result of a non-linear process in the receiver, it is often highly specific to one of the weather satellite frequencies: in my case 137.62 MHz is much more affected than 137.50 MHz.

Figure 2 illustrates the effect of CRT monitor interference. This shows up as diagonal bars across the image and, like the pagers, is worst at the beginning and end of passes. By counting the number of bars across the image and doubling it (to allow for the fact that the image width corresponds to 0.5 seconds), you obtain the frequency. In the example shown there are 44 bars, which translates into a rate of 88 Hz. The monitor vertical scan rate is supposed to be 85 Hz: near enough!

Power line interference (*Figure 3*) also looks just like this, except that each half-cycle of the a.c. generates a bar; so there will be twice as many bars as the line frequency.

Modem interference is rather more subtle. As noted, many 14400 bps modems seem to generate a signal at 137.62 MHz and not at the other frequencies used by weather satellites. This signal is fairly stable and co-channel, and it affects the image in two ways. By interfering with the satellite signal it tends to prevent receiver lock-up, delaying acquisition and collection of the image. During collection, it shows up as a faint herringbone pattern or streaky pattern all over the image. I have not observed this type of interference with other types of modem: in particular 2400 bps, 33.6 kbps, and V92.

General computer interference is similar to noise: it can be heard aurally from the receiver as noise and tends to raise the receiver noise floor, delaying signal synchronisation and shortening the pass duration. You can check if you have it by listening to the audio output of the receiver and turning the computer off.

Problems are sometimes encountered with antennas which appear to be due to interference but are not. *Figure 4* illustrates this, with a portion of an image which has a pager bar but also a noise bar. In this case, the antenna in use was an experimental one (a quadrifilar) possessing a null in the reception pattern which gave rise to the noise bar. It also had a more rapid drop in signal strength at low elevations than is normal. This type of problem can be recognised by the fact that the signal fades smoothly into noise and then back out of it.

Figure 5 shows a GOES 8 image exhibiting co-channel interference from GOES 10. Although GOES 10 was not operational at the time the picture was taken, its 1691 MHz transmitter had been turned on to warm the spacecraft during the eclipse season, with the results shown. My antenna was a 44 element yagi, which had enough gain to receive the WEFAX signal, but not enough directivity to exclude the GOES 10

signal which was about 40° in azimuth away from GOES 8. Four-foot dishes also fall into this category.

Figure 6 (thanks to Alain Nierveze) shows interference experienced from an *Orbcomm* satellite when receiving NOAA-17. The Orbcomm satellites use 137.56 and 137.6625 MHz, very close to the NOAA frequency of 137.62 MHz, and uses data frequencies of 57.6 kHz in bursts, one of which can be seen in the upper left hand corner of the image. It is interesting to note that the interference burst is almost perfectly synchronised with the NOAA-17 APT scan, giving rise to the straight lines running down the screen.

Curing the Interference

Pagers

Much has been written on the problem of pager interference. It would take up too much space to repeat it all here, so I will give a short summary. As the problem is in the receiver, and due to overload of the receiver's early stages, it helps to reduce the interfering signal if this can be done without reducing too much of the wanted satellite signal. For example, antenna preamplifiers are good for the system noise factor, but amplify the already very large pager signal by 30 dB or more. Removing the preamp can often effect a significant reduction in interference, if not a cure. You may then want to replace the co-axial cable connecting the antenna to the receiver with a low-loss variety such as *Belden 9913*. Make sure you select double screened cable, as this helps avoid pick up of various types of interference, such as computer emissions, on the feeder.

If the interference persists after taking these steps, the addition of a helical filter before the receiver may help. In my case, a three-stage custom helical filter was built which gave 1.1 dB of loss to the wanted frequencies while attenuating the unwanted pager signals by 57 dB and 26 dB. (Fortunately, the pagers were on 140.16 and 141.40 MHz.) If your pagers are within a few hundred kHz, as some are in the UK, the filter will not be able to help you. All other simple types of filter, such as tuned stubs, have inadequate Q to discriminate between the wanted and unwanted signals.

Computer

It is difficult to offer advice with computer interference, as it is invariably picked up by the antenna (or feed coax), and is therefore very sensitive to relative location and orientation. Moving the computer around the room to find a quiet spot is one solution. If the receiver is connected to the PC via a screened cable, check that the cable is of good quality with well attached connectors. Looping the cable through ferrite rings can prevent interference being transmitted along the outer conductor. Checking the connectors on the co-axial cable from the antenna to the receiver can also pay off, if there is poor contact to the outer screening.

Some 14400 baud modems can be turned off by issuing the command 'ATS24=1' in a terminal window—this sets the internal timer to turn the modem off after 1 second. (This command is meant for use with battery operated modems but the commands have been carried through into desktop modems in some cases). You will have to repeat the command if the phone rings! If this does not work with your modem, removing or replacing it with another type seems to be the only cure.

The monitor should be kept well away from the feed cable between the antenna and the receiver. Changing the relative orientation of the monitor, the cable run and receiver may also do the trick. The monitor can be turned off during passes if a quiet location cannot be found. The energy-saving mode can be used for this if desired. I would note here that my old monitor (SVGA, circa 1990) did not produce any interference, but my newer one (1995, with 'low emission'), does produce a lot, as Figure 2 shows.

If all else fails, resorting to recording the signal on a tape recorder for later playback into the computer is one approach which enables the computer to be switched off during satellite passes.

Power Lines

This type of interference, once identified, has to be handled through the owners of the power lines concerned. At least in the continent I lived in (N. America), most authorities are aware of the potential for problems and are sympathetic to doing something about it provided you can demonstrate to them that it is a power line problem. To do this you must exclude all other possibilities and, by counting the number of bars, get a strong indication that the interference is at power line frequency. If the interference varies with weather, log the severity and the weather conditions, keeping copies of the imagery you get in each case. To the expert from the power company, a statement that the interference is worse when the wind is blowing, or better when it is raining, contains much useful information about the likely cause of the problem. When I suffered power line interference the culprit turned out to be 3300 volt insulators on a pole about 500 metres away. The same pole also carried 11 kV and 33 kV lines, and I had a 275 kV line about 300 metres away. The expert tracked down the source of the problem within an hour or so and fixed it the same day.

Co-channel Interference

These days, this type of interference with APT signals is almost exclusively a problem with Orbcomm as the Meteosat and GOES geostationary satellites have long since discontinued the dissemination of Wefax.

There is little or nothing that can be done about co-channel interference as the satellites are using allotted frequencies and

Forums

Fred van den Bosch

General

Below is described a program that can check a maximum of 15 Yahoo forums for new messages. As soon as a new message is posted, an announcement will pop up on your computer screen (figure 1).

Background

In 2003, Arne van Belle [1] wrote of the appearance of a new phenomenon: the Internet mailing list. I, and undoubtedly many others, registered with one or more forums as a result of this article. Nowadays there is a wide choice [2] and [3] within our sphere of interest. The great advantage is that many people may already have experienced the problems which you yourself encounter and searching on a forum can frequently produces a solution. If not, then asking the question on a forum nearly always guarantees a direct response, frequently with the solution.

I am a member of a reasonable number of forums and enjoy checking for new additions each day and set up a number of favourites in *Internet Explorer* to access them. But could it be done more simply, without me having to do anything myself (my well-known idleness)? Then I recalled that I had written a piece of coding for my POVIM alert programme that made a number of checks on Internet sites for the presence of data. To check for new postings on a forum would be even easier as only the date and time of the most recent mail need be examined. Once this had become clear, the program was written in no time at all!

However, only the Yahoo forums can be examined in this manner as they all have, as it happens, the same structure. On other forums the matter is frequently subdivided in several subjects, so would require a separate piece of coding for each forum

Visit

http://www.fredvandenbosch.nl/ downloads.html

and download *POVIM Forums,* then unzip it into an appropriate folder. Run *Forums.exe*, and after a short pause, a window appears (figure 1) with a number of forums listed on it. When run the first time, the program shows the forums which I myself have added. A maximum of 15 forums can be inserted.

You can add your own selections by means of copy and paste (or Ctrl-C and Ctrl-V). Forums can be removed by deleting a field. The order is not important.

As soon as a new message appears on a forum it will be shown in the window on a red background. Because the software must check <u>all</u> the forum entries after starting up, there is a short delay before the screen appears.

Program Features

In the 'Check' panel are two fields to complete:

- <u>Every x minutes</u> controls how frequently the program checks the status of the forums.
- <u>Start minimised</u>, If ticked, minimises the program directly to the system tray; otherwise the program window remains visible.
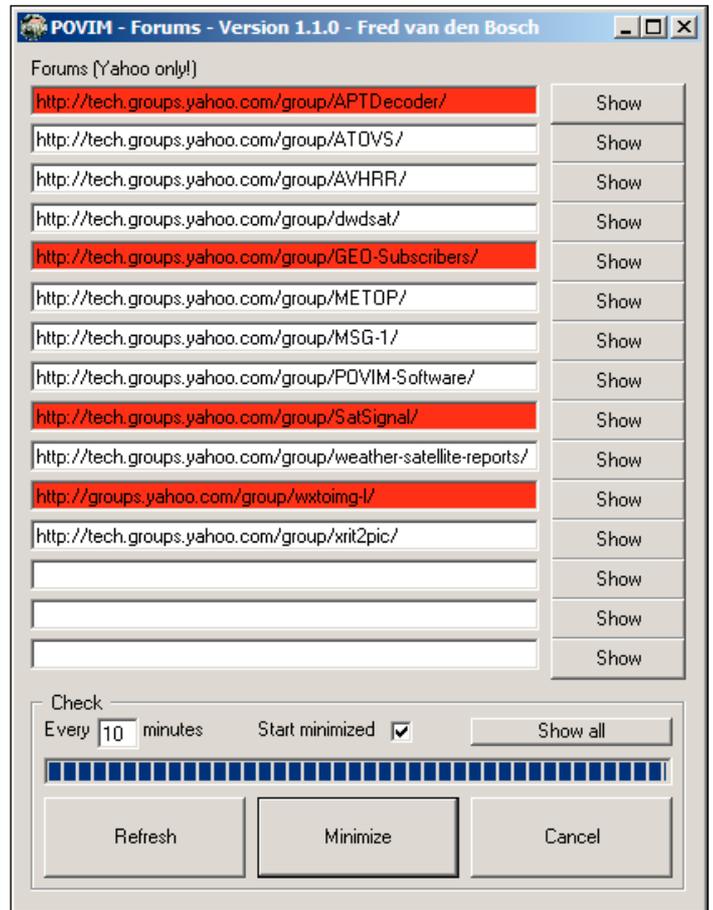

Figure 1 - The *POVIM Forums* screen

Buttons

- <u>Show all</u>: All forums with new messages are shown (<u>Beware</u>: the default browser must be open)
- <u>Refresh</u>: all forums are again checked and a status bar indicates the progress. In the case of problems, the refresh-buttons themselves cannot occur be used. The other tests work, however.
- <u>Minimise</u>: sends the program to the system tray.
- <u>Cancel</u>: closes the program
- <u>Refresh</u>

## Future developments

I am always interested in comments on my programs. Questions can be asked on my forum:

http://tech.groups.yahoo.com/group/POVIM-Software/

References

1   Mailing lists:
    Hoe Werkt Dat
    Arne van Belle
    De Kunstmaan, October 2003, p.103
2   Discussion groups on the Internet:
    Redactioneel
    De Kunstmaan, December 2006, p.159
3   Fred van den Bosch
        http://www.fredvandenbosch.nl/links.html
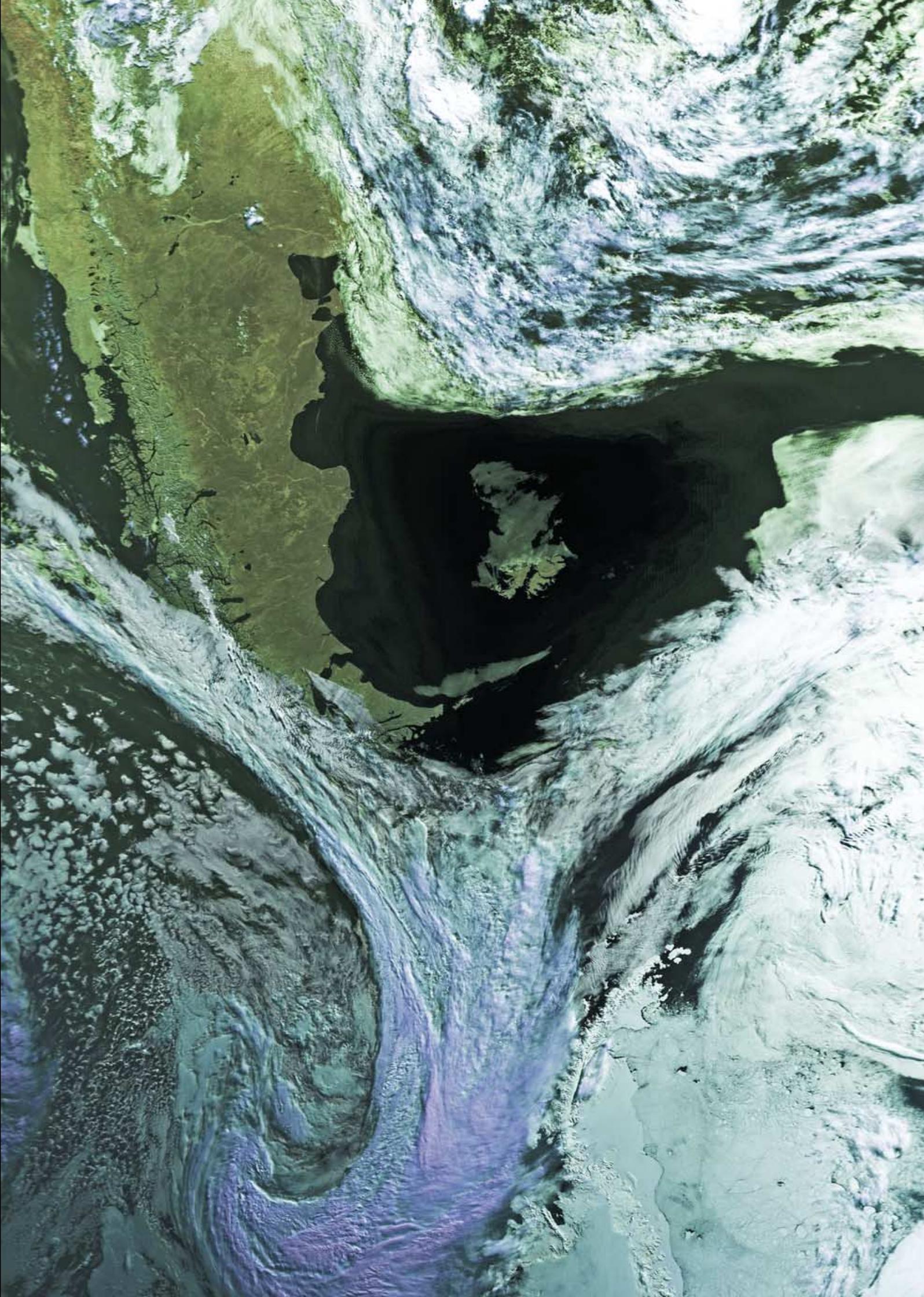
Satellite Communication Systems' Link Budgets

Alan Sewards

Introduction

Many of the people who have constructed MSG systems using the EUMETCast broadcasts from the Hot Bird-6 satellite have looked, at one time or another, at the S/N (signal to noise) ratio and BER (bit error rate) data provided by the SkyStar software. Some have observed that this data exhibits quite large changes from time to time, sometimes accompanied by loss of imagery. It is the purpose of this article to take a look at the *link budget* that defines the level of the various signals in a satellite communications system, why they are what they are, and why, sometimes, the levels change in an unplanned way.

My original plan was to start with a graphical construction showing the ground stations of the link together with the satellite, with the equations governing each part in the appropriate place. I then intended to use the link budget for the EUMETCast service as an example and discuss it in detail. I requested a copy of the link budget through OPS, and was rather surprised to receive a very polite reply saying they could not supply one because the link budget was regarded by *T-Systems*, providers of the link, as proprietary. I can only suppose that was the result of the emergency action that had to be taken to get EUMETCast in place when the downlink transmitter of Meteosat 8 (MSG-1) failed shortly after launch. Certainly, in my own experiences, the link budget was the result of a cooperative effort between the link provider and the user or customer. In any event, I had to re-think the concept, and in doing so, I concluded that if the *T-Systems* link had to go, the equations might as well follow it. As a result, this article is couched in more or less general terms, although I have tried to use concrete values wherever possible.

Elements of the Communications Link

A satellite communications system consists of an **uplink**, a satellite, and a **downlink**, together with associated ground stations. From the user's viewpoint, most of the action occurs in the downlink, and it is on this that we will concentrate; but the uplink needs to be understood as certain of the observable effects occur on it.

At the uplink, a ground station produces a signal that is transmitted up to a satellite via an antenna that usually tracks the satellite, although for satellites in geostationary orbit this is not strictly

necessary. At the satellite, an antenna oriented towards the Earth receives this signal and feeds it into the transponder, which, despite its name, is functionally an amplifier. At the transponder output, the amplified signal is fed into another antenna that radiates it back to Earth, towards the user. The user employs a ground station consisting of an antenna and receiver to recover the signal.

Uplink

The uplink usually involves only a single ground station, so cost is not critical and the design of the ground station can be optimised to reduce costs in other parts of the system—such as the satellite or the user stations, of which there may be thousands. In particular, the ground station can employ a powerful transmitter and big antenna to ease the requirements at the satellite for a receiving antenna and receiver. The goal is to get a noise-free signal into the input of the transponder. Depending on the design of the transponder, there may be a need for fine control of the transmitted signal.

Satellite

The satellite requires a receiving antenna to collect the uplinked signals. As there may be many transponders on the satellite (24 is a common number) covering a number of different frequencies, the antenna is normally associated with microwave plumbing (multiplexer/demultiplexer) which separates the various frequencies and passes them to the appropriate transponders.

The transponder consists of a microwave amplifier (formerly a travelling wave tube but nowadays usually a solid-state amplifier) which amplifies the signal to the level required for retransmission towards the Earth (power levels range from watts to hundreds of watts). The amplified signal then goes in another microwave multiplexer to combine signals for radiation from the various transmit antennas. The satellite may have a number of downlink antennas providing beams for coverage of particular countries or zones, and transponders must be able to be connected to any of the antennas that might be needed, taking account of redundancy, to cope with in-service failures.

Finally, the transponders may operate in *saturated mode* or *linear mode*. If the

transponder is carrying a single carrier, such as an analogue TV signal, and the modulation type is constant envelope (such as FM), it may be operated in saturated mode where the amplifier is driven into saturation. This simplifies uplink power control and has the incidental advantage that variations in uplink signal are largely suppressed. However, if the transponder carries multiple carriers (as does the one carrying the EUMETCast signals), it must be operated in linear mode to avoid problems with intermodulation and power sharing between the various carriers. In this mode the amplifier simply amplifies the uplink signal and any variations in it are faithfully reproduced at the output.

Downlink

The transponder output is at a power level adequate to transmit the signal to the user stations on Earth and is fed into the transmit antenna which contributes its gain. The combined effective radiated power is usually specified in terms of dBW, and contour maps are produced showing the variation of the power across the coverage area. An example can be found at

*http://www.eutelsat.com/satellites/
13ehb6_popd.html*

which shows that the Hot Bird-6 satellite has an effective isotropic radiated power (EIRP) of 53 dBW at the peak of the antenna beam (that is 200,000 watts).

The radiated signal is attenuated by the free-space radiation loss (square law), plus any atmospheric or ionospheric losses and arrives at the user ground station antenna as a power flux density that is intercepted by the antenna. The signal appearing in the antenna feed is proportional to the flux and the antenna aperture, and is passed to the receiver, together with any noise inherent in the process. Noise is produced by the receiver front-end amplifier and the antenna itself, plus any received by the antenna from space or the Earth or the path through the atmosphere.

In a typical user ground station, the noise level is determined by the LNB (low-noise downconverter block). This item, consisting of a horn antenna (the feed horn) and a downconverter for a block of frequencies, is located at the focus of the dish. The feed horn is linearly polarised and is rotated in its holder to obtain the desired polarisation. Note here that the horizontal or vertical

polarisations specified for the various channels are only horizontal or vertical at the LNB for a satellite at the same longitude as the user. At other longitudes it is necessary to skew the feed horn to match the polarisation of the incoming signal. Overall, the sensitivity of the ground station depends on the ratio G/T of the antenna (G=antenna gain, T=effective temperature of the antenna).

Putting all the numbers into the equations shows what the resulting signal to noise ratio should be. This figure can then be compared with the specified signal to noise ratio required for the bit-error rate necessary for the channel. If it is greater, the difference is referred to as the *margin*. It is available for temporary reductions in signal strength caused by rain, or other losses such as misalignment. If the *margin* is zero or negative, the channel is on the verge of not working, and the slightest signal variation could result in the bit error rate rising above the specified value.

User Ground Station Requirements

An obvious additional point is that the receive antenna should be accurately pointed at the satellite. This is less easy to achieve than it seems. If the geostationary satellite is well maintained in its allotted station and has virtually no orbital inclination, it appears to stay in the same spot in the sky all the time. If these conditions are not met, particularly in terms of inclination, the satellite appears to move in the sky in a figure-of-eight once per day. If you line up your dish using signal strength when the satellite is at the top or bottom of its '8', the signal will be lower than it should be most of the time. Happily, the 1 dB beamwidth of a 1 metre dish is about 1°, and as commercial satellites are kept to much closer tolerances than that, one should not see even 1 dB variation due to this effect. In practice, the simple method of finding the satellite by moving the dish in elevation and azimuth for a maximum, and then fixing it there, works tolerably well. Tightening the bolts usually throws the setting off, so check that this does not

happen. Even taking all precautions, it is probable that, if instruments are not used, the antenna could misaligned to the extent that 1-2 dB of possible gain is not realised if the loss due to incorrect polarisation skew is added. Another problem can arise if your location is on the extreme edge of the coverage area of the satellite, where the satellite motion could carry your location down the skirts of the satellite downlink beam—this has been known to happen with the *Sky* system for viewers in Portugal. So beg, borrow, or lease some instruments when you align your dish, or at least use the built-in software indications.

Link Impairments

What can go wrong and cause reductions in the expected signal strength? Starting at the user's receive antenna, there are various possible mechanical problems with the LNB and cable/connectors. These are fairly obvious and won't be discussed further here except to say that they should be checked first in the case of any problems—loss of signal is often traced to a poorly installed connector on the cable to the LNB or corrosion due to water ingress into the connector.

The most serious and common cause of temporary signal reduction is rain. Rain strongly attenuates Ku band signals depending on the amount of water in the path between the satellite and the receiving antenna. The intensity of the rain and the thickness of the belt of rain in the path are the important factors. Rain rates of up to one millimetre per hour exhibit little effect, while 10 mm/hr and greater causes serious fades of up to 10 dB (or more). As noted in the discussion above, heavy rain also increases the noise level at the antenna, further reducing the signal to noise ratio.

Trees and their foliage are also potential absorbers of the microwave signal. This fact is often forgotten if the tree was bare when the antenna was installed. This is a problem that will increase with time as the tree grows. Trees also increase the received noise level as the antenna is

looking at something at ambient temperature instead of cold free space. And leaves can retain rainwater long after the shower has finished.

Twice a year, for a period extending over a number of days, the sun will pass directly in the line-of-sight of the antenna. As the sun is very hot, it radiates a strong noise that degrades the received signal-to-noise-ratio and shows up as a fade. This only lasts for a few minutes: the time taken for the sun to transit the antenna beamwidth of a few degrees.

At the satellite itself, it is rare for anything to happen that affects the downlink signal. The spacecraft is carefully controlled in attitude to ensure that it stays in its allotted 'slot' and that its orbital inclination is kept within the permitted value. However, periodic adjustments to the orbit are required to achieve this, and these are done by use of the on-board thrusters or the operation of gyros. Such manoeuvres change the attitude of the satellite and this has consequential effects on the beams of the downlink antennas. Depending on where in the beam a ground station is located, there may be an appreciable effect on the signal strength, or little or no effect. It is likely that most of the small unexplained variations in signal strength observed by users of the EUMETCast service arise from this cause.

At the uplink, provision of redundant critical equipment ensures reliable operation with the sole exception of rain. Rain has the same effect on the uplink signal as it does on the downlink, and heavy rain can result in deep fades in uplink signals which appear as deep fades in the received downlink signal at the user terminal. This is all the more puzzling to the user as there may not be a cloud in the sky at his location! In theory, it would be possible for the uplink station to compensate for an uplink fade by controlling the uplink power, but this would not be attempted for a transponder carrying a multiplicity of separate signals nor for situations where the signal was varying rapidly in time.

GEO Readers' Internet Survey

Readers who have been subscribers since our Launch Issue four years ago may recall we included a survey form with that Quarterly. Although we did publish a sample of the replies, it proved physically impossible to take everyone's views on board.

GEO would now like to offer its subscribers the opportunity to voice their opinions on the Group **and to help shape its future**. To this end, we have placed a new Survey Form on our website, which we would very much like you to complete.

www.geo-web.org.uk/survey08.html

A summary of the results will be published in the Quarterly later in the year.

Aral Sea Update

Les Hamilton

As reported in GEO Quarterly No 16 [1], the first phase of the project to restore the northern Small Aral Sea—through improved water management on the Syr Darya river and completion of the Kokaral Dam across the Berg Strait—was proving much more effective than had ever been imagined. The image below, acquired by the Advanced Visible and Near Infrared Radiometer (AVNIR-2) aboard JAXA's *ALOS* (Advanced Land-Observing Satellite) on October 10, 2006, clearly shows the Kokaral Dam. The ground resolution on this image is a staggering 10 metres!

The 13km-long Kokaral Dam forms a wide V-shape in the centre of the scene. The lock in the middle of the dam shows up clearly, as does the white spray of water flowing through it towards the Large Aral Sea. The Syr Darya river can be seen entering the North Aral Sea a short distance east of the dam.

The Kokaral dam was originally designed to raise the water level of the North Aral Sea from 38 m to 42 m above sea level. At the present time, the waters of the North Aral Sea have already risen very close to the top of the dam.

Consequences of the rising sea level have included more frequent rains in Aralsk and a generally quieter climate with fewer sandstorms. In addition, fish and wildfowl have returned as the water level recovered. Fishermen are returning to the city and are planning to revive the fishing industry by stocking the sea with millions of young fish and reintroducing the sturgeon.

The second-stage of the $126 million project is planned to commence in 2009. This will include construction of a second dam, 20 kilometres in length, to raise the level of the North Aral Sea even more, plus a canal 46 m above sea level (higher than the new dam), which will extend directly from the Syr Darya River to bring water to the harbour in Aralsk once more.

Reference
1   Aral Sea - Les Hamilton - GEOQ 16, p 25.
Credit
Image: JAXA (Japanese Aerospace Exploration Agency)

The Kokaral dam separating the North and South Aral seas
Image: JAXA

Saharan Dust Sweeps Across Eastern Europe

Compiled by Les Hamilton from reports by
Rob Denton, Nigel Heasman, Alan Sewards, Dave Kitchenham and John Wills

Throughout two days during March this year, a plume of dust blew from the eastern Sahara desert across the Mediterranean Sea, passing over Cyprus, eastern Europe and a large part of the Black Sea. The phenomenon was first captured by the MODIS instrument flying aboard NASA's *Terra* Earth Observation Satellite on March 23, which acquired the scene presented at the far right of page 35, showing the dust plume just brushing the western tip of Cyprus then dog-legging east over Turkey and the southern Black Sea.

A day later, the *Aqua* satellite acquired the beautiful image you saw on our front cover, which now shows the translucent plume of dust and sand completely enveloping Cyprus. The image on page 35 was created by combining the 08:20 and 08:25 UT images, downloaded from the *MODIS Rapid Response* website, then processing them with *SmoothMODIS* and *CorrectGeometry* as explained on page 11, before finally splicing them together in *Photoshop*.

Image: MODIS Rapid Response Team at NASA/GSFC

Several *GEO Quarterly* readers observed the event through their satellite images: along with others living in proximity to the path of the dust cloud, they maintained an informative dialogue on the *GEO Subscribers* Internet forum until it dispersed. Their collective observations form the basis of this report.

Day 1 - March 23

The first sign of anything unusual in the offing came from Rob Denton in Bulgaria, who reported 'an interesting cloud cover at the moment' during the early morning on March 23. Although the sky was unbelievably dark for daytime and there was no rain falling, it seemed to be interfering with GPS signals. The temperature was a cool 11°C although it felt much colder.

Nigel Heasman was monitoring events from northern Cyprus through both APT and MSG-2 and noted that the cloud mass was showing an 'incredibly well defined western edge'. A Meteosat-9 animation showed it

developing over north Africa and moving northeast, carrying a lot of sand with it. Nigel provided the false colour MSG image at the top of page 35 (figure 3). Although it looked as though it should have been producing lots of rain, there was none.

Shortly before midday, Rob set off walking his dog and was soon overtaken by the advancing western edge of the cloud. Strangely, there was absolutely no wind at all at ground level as the cloud passed over. Almost instantly, the temperature rose by 5°C, and continued to increase, so much so that he returned home sweating. After needing the heating on indoors earlier, it was now a case of opening the door to allow the warm 20°C Saharan air in. The sky was now visible with a high-altitude haze due to the sand and dust.

Alan Sewards entered the debate, noting the remarkable extent of this 'sandstorm'. By mid-afternoon, the cloud mass extended almost 2000 km, and the suction channel over the African coast, from where the sand was being drawn, was about 200 km wide.

> '*There must be a lot of sand sitting up there waiting to come down with the rain*'.

The Meteosat HRV images were showing a great deal of detail in the suction channel; one could even see dust plumes being kicked up by the wind as the front moved across the ground.

In Cyprus, the sky was becoming increasingly hazy as sunset approached though the sand had yet to fall to ground. Interestingly, the humidity increased while the temperature remained almost constant, even two hours after sunset. And completely still at ground level.

Facts and Figures

After spending some time making a detailed analysis of MSG images, Alan discovered that, at 1500 UT, the cloud tops of the main mass of cloud were at a temperature of -66°C, which meant that they were high-altitude clouds, probably between 12,000 and 15,000 metres. At the same time, the temperature of the sand clouds (while still over the Sahara), were at 0°C or less, indicating that they had already been lifted to around 3,000 metres.

Day 2 - March 24

It remained extremely hazy next morning in Cyprus but no sand or dust had come down. Satellite images showed that the dust continued to blow northward from Africa. Temperatures has increased throughout the night and it was already 22.6°C by 10 am local time!

Synoptic Details

The synoptic chart below relates to midnight at the conclusion of March 23, which shows high pressure over the region of the suction channel.
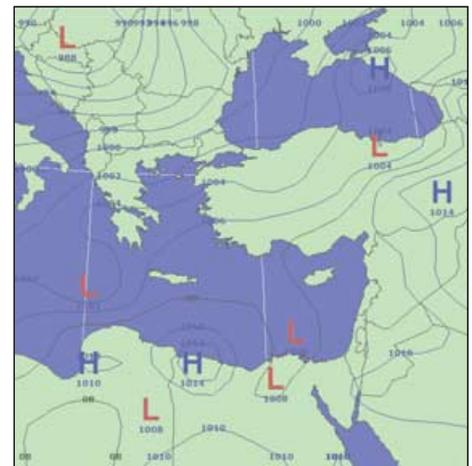

Figure 1
The sea-level pressure chart
at 00:00 UT on March 24
Chart created with Digital Atmosphere Equinox

Alan noted that the dense black cloud ignored the presence of this high pressure and just sailed over it, strongly suggesting that it was associated with the jet stream. Looking back to imagery dating from the start of the phenomenon, in southern Tunisia at around 12:00 UT on March 22, some strands of typical jet stream cloud travelling from SW to NE were evident. Quite suddenly, within the space of an hour, these became mixed up with a sandstorm and the sand began to track NE. The intensity rapidly increased until the cloud took on the appearance of figure 2.

So, it looked as though the 'black cloud' was a jet stream cloud which had somehow become laden with sand; but how the sand got up from ground level to the stratosphere, and why it kept rising until the
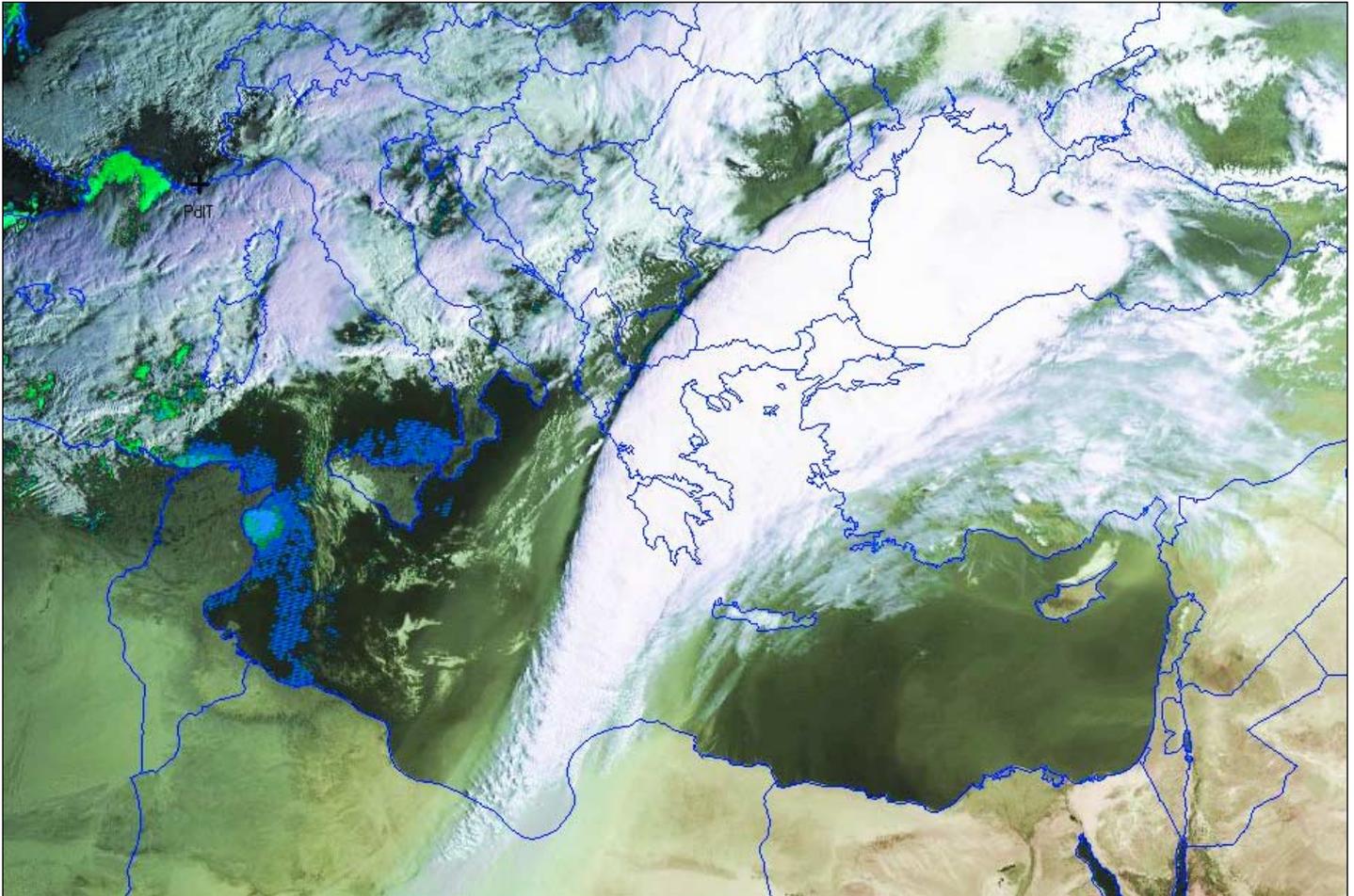
Figure 2
The cloud and dust plume, imaged at 06:30 UT on March 23 by Alan Sewards
Image © EUMETSAT 2008

source was cut off, is a mystery. But Rob's observation that there was no wind beneath the cloud certainly seems to tie in with it being a jet stream cloud.

Around 15:00 UT, with the temperature in Bulgaria an incredible 25.6°C (for March), and snow forecast for the following day, Rob at last found his car dusted with Saharan sand So spectacular was the dust cloud that it made the television news in Bulgaria (though not the weather forecasts), and the *Sofia News Agency* reported 'brown rain' falling over the city of Sliven, where it 'covered buildings and car windscreens' and left brown blotches all over the ground.

In northern Cyprus, however, Nigel reported only a little, very fine, brown sand, hardly enough to bother with, and absolutely no rain! Meanwhile, Dave Kitchenham, a member from southwest Cyprus, reported that he had experienced an unseasonably warm night with an overnight low of 20°C. The morning had dawned very hazy but with an otherwise clear sky and a light coating of brown dust on everything.

The Aftermath - March 25

Nigel photographed the scene as the dust cloud passed overhead and finally cleared his location (see satellite image on front cover). Before the clearance, a strong sand-induced haze had reduced visibility

significantly (figure 5), yet only an hour later, as the dust cloud receded eastward, the sky became a deep, clear blue figure 6). Following this dramatic clearance, the wind suddenly picked up from a mere 5 km/h to around 30 km/h while the temperature fell from 20°C to 15°C—and it suddenly felt quite cool. The dark layer of dust was topped by white cumulus which made it stand out very well (figure 6).

Dave confirmed that the dust cleared eastwards very suddenly around noon and seemed to have a distinct boundary edge. Temperatures dropped to a more seasonable 22°C. No rain fell throughout the event.

Cyprus' Coptic Winds

John Wills, submitted figure 2, a NOAA-18 APT image acquired around 11:00 UT on March 25 from his location in southern Cyprus. The dust storm had been hanging over Cyprus for several days but, on the 25th, a *Coptic Wind* sprang up and started to clear the dust away from the island.

For several days before the 25th we had experienced hazy sunshine due to the dust, and temperatures well above seasonal average. The morning of the 25th began similarly hazy, and very warm, but by late morning a strong westerly wind was developing, which gained strength, clearing

the atmosphere and lowering the temperature to the seasonal norm. This *Coptic Wind* lasted for approximately three days .

According to reports in the Cyprus newspapers, the frequency of dust storms is on the increase. Whereas a few years ago Cyprus could expect two or three dust storms a year, they have now increased to 10-16 per year.

During this particular storm, dust levels reached three times the EU recommended level of 50 micrograms per cubic metre. It was further reported that cardiovascular incidents have risen by 10% during these increasingly frequent Saharan dust storms .

The *Coptic Winds* are a series of thirteen winds that occur throughout the year in Cyprus and each has a name.They have been known since antiquity and almost always arrive plus or minus 24 hours of their predicted date.

One—called '*Hawa*'—was predicted to arrive on March 25, and did so on time; it's name means the *wind gale*. The previous Coptic Wind, due on March 20, was '*El Shams El Kebira',* which means *Big Sun Gale.* The next one is '*Khamseen Winds'*, the *Sand Laden Wind*, due on April 29.
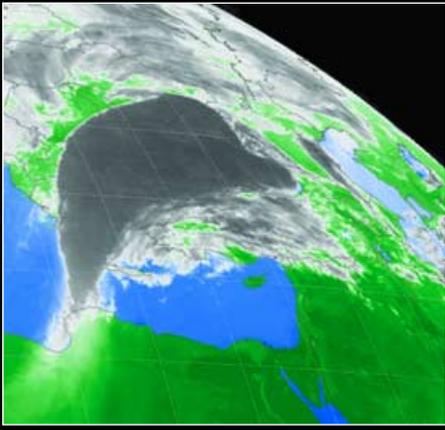
Figure 3
False colour image of the dust cloud
*Image: Nigel Heasman*
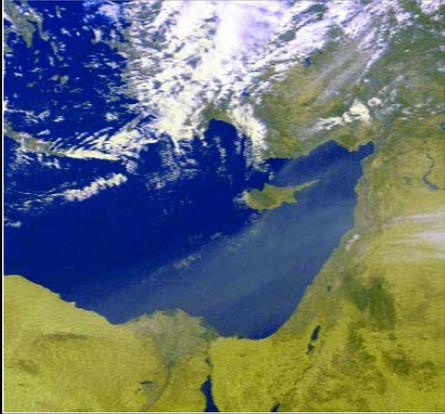
Figure 4
A false colour NOAA-18 APT image from
southern Cyprus showing the dust cloud
at 11:00 UT on March 25
Image: John Wills

Figure 5
The dust arrives, causing thick haze that almost
obscured a mountain just 10 kilometres distant.
Photograph: Nigel Heasman

Figure 6
The dust cloud departs, topped by fluffy
white cumulus cloud.
Photograph: Nigel Heasman
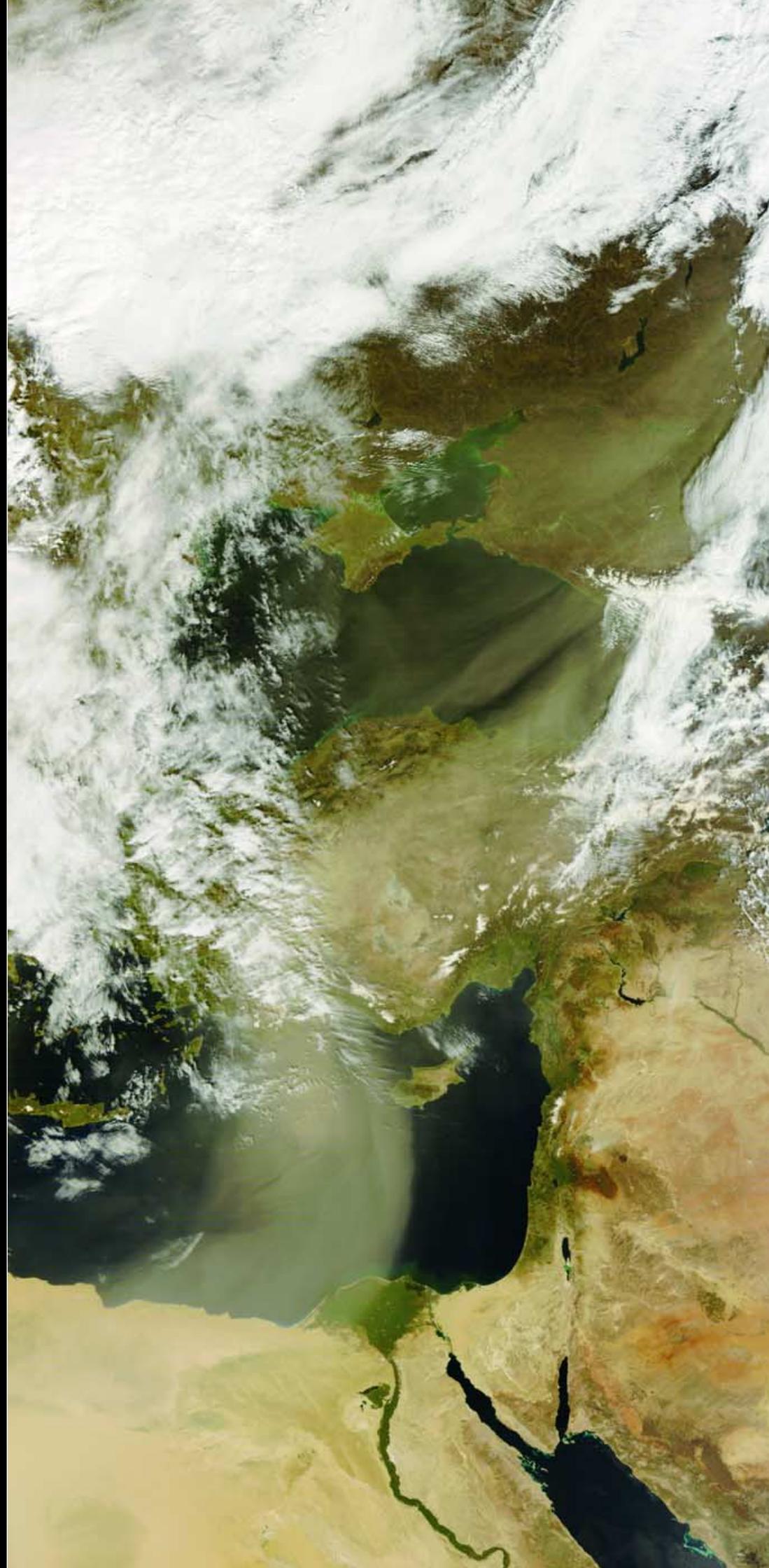
Bolshaya Ipelka

Les Hamilton

Early this year, Robert Moore initiated a discussion on the *GEO-Subscribers* Internet forum regarding a prominent feature seen in images of Russia's Kamchatka Peninsula. 'A clear circular object with incised contours', the feature had the appearance of a large volcano situated at 56.6°N 157.2°E. The location is circled on the NOAA-17 image below, acquired on January 19.

Image: NOAA CLASS Archive

The structure is a massive early Pleistocene shield volcano called **Bolshaya Ipelka**. Located on an east-west tectonic line, this large volcanic caldera, surrounded by a ring-shaped ridge with steep inner walls and rocky outer slopes, comprises the remains of a great volcano that has been extensively eroded by glaciers. It is the largest volcanic structure in southern Kamchatka.

Detail of the massif's radiating ridges is revealed in the 1972 Landsat image at the top of this page and in the superb astronaut image taken from the ISS in 2002.

A Landsat image dating from 1972
Image: NASA
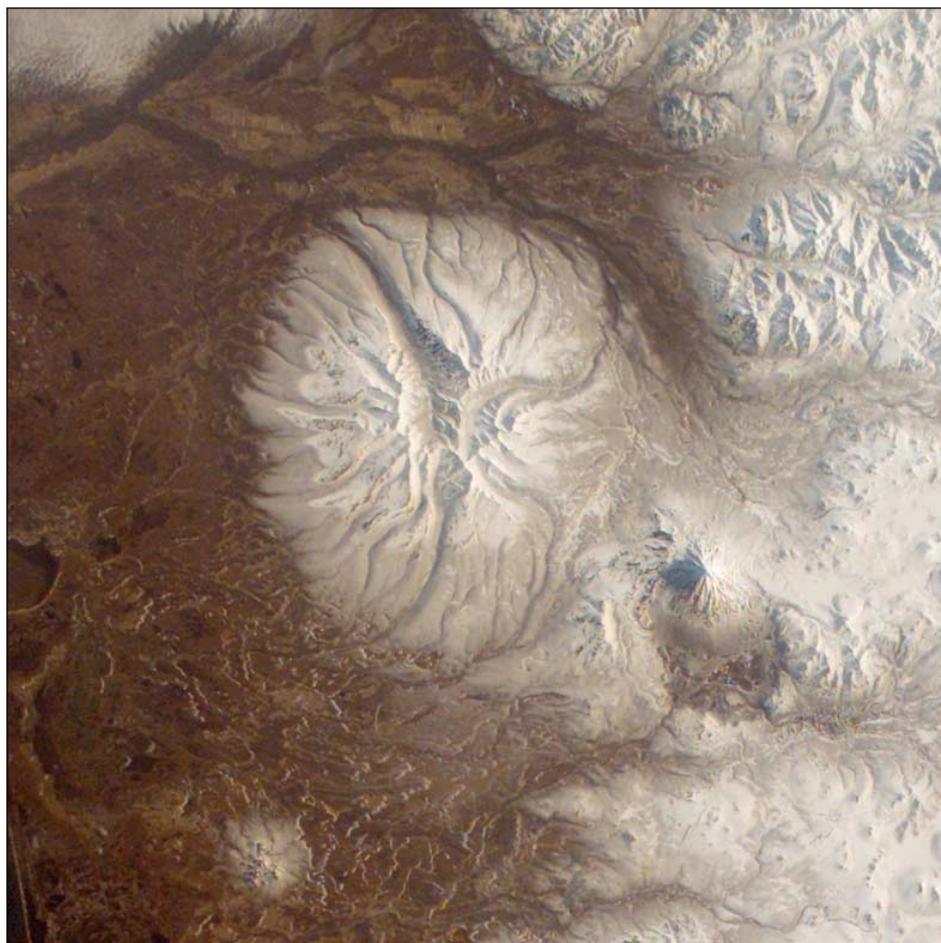
Snow capped Bolshaya Ipelka, imaged from the ISS in 2002
Image ISS004-E-11691 courtesy of the Image Science and Analysis Laboratory at NASA Johnson Space Center (http://eol.jsc.nasa.gov/).

Buran   ... the forgotten Soviet Space Shuttle

John Tellick

I'm sure we are all aware that Russia has a successful space industry, a spin off from the Soviet era: several European satellites have been launched on their rockets, and Russian supply vessels help to service the ISS. But I wonder how many remember or know of the Soviet space shuttle?

German TV news programmes on April 7 showed what was clearly a 'space shuttle' being transported down the river Rhine, on a massive barge, for a 385 mile journey from Rotterdam to the Technik Museum in Speyer, SW Germany. This was a relic from the Soviet era, the Buran space shuttle, the tail having been removed to clear low bridges during transit. Having forgotten about this craft, I did a little research.

Development of Buran began in the early 1970s as a response the US Shuttle programme. It seems Soviet engineers favoured a smaller lighter vehicle but the military pushed for a direct copy of the Shuttle in order to maintain 'super-power parity.' The construction of the Buran shuttles began in 1980 with the first full scale vehicle rolled-out in 1984. Sub-orbital test flights had taken place during 1983 using a scale model.

I seem to remember quite a bit of publicity about the craft and one was impressively on display atop a Soviet Antonov 225 aircraft (specially built to transport the Buran, and still the largest aircraft in the world) at the 38th Paris International Airshow at Le Bourget in June 1989.

The Buran Shuttle

The Buran 1.01 launch on an Energia booster.

Buran being carried down the Rhine to Speyer

Buran atop a Soviet Antonov 225

Several craft and/or prototypes were built but only one was ever launched into space: Buran 1.01, from Baikonur, on a specially designed Energia rocket, on November 15, 1988. It was unmanned and orbited the Earth twice in 206 minutes before making a successful automated landing back at Baikonur, despite windy conditions, on a specially constructed shuttle runway. Some of the other craft were, apparently, fitted with jet engines in order to test their handling in the atmosphere and sub-orbital flight.

Of course, this was the era of the Mir space station, and a shuttle would have been a great asset in servicing it. It has to be said that the Soviets did an amazing job building Mir without a shuttle.

I think it's correct to say there were many problems with the Buran and the project was cancelled in 1993. On May 12, 2002, a hanger collapsed due to poor maintenance, killing eight people and destroying a Buran shuttle, which is thought to have been the 1.01 that actually orbited the Earth. Also destroyed was a mock-up of the Energia booster rocket.

A new hall has been built at the Technik Museum Speyer to house the Buran shuttle. Their many other exhibits include a Soviet Concordski, a French Concorde and a jumbo jet. Dare I suggest that the Buran suffered a similar demise to the 'Concordski'—the Tupolev 144.

GPS in Weather Satellite Stations

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GPS in my weather station I hear you say? This is what sparked me to write this article after one comment by a member on the *GEO-Subscribers group* on the Internet: 'surely they don't still use that!' Well I certainly do—and I know of many others who do. It's not as antiquated as you think. My PC clock is never more than half a second in error, which results in perfect overlays on my images. GPS will also serve well in the upcoming lightning display project I'm planning, where synchronisation is important when sharing information with other stations for triangulation purposes.

In order to receive accurately aligned overlays on weather satellite images, your PC clock must be accurate and the Keplerian data you use must be up to date. I have read numerous messages from members of Internet bulletin boards stating that their system was not working properly. Many blame the software and it's creators, when all they need to do is keep accurate time on their PC. Many of us were ignorant of the fact (myself included) that if a PC clock is inaccurate the software will simply not work as intended. That's why much of the weather satellite software includes a facility to keep time, change coordinates for those who operate from different locations, and keep Keplerian elements up to date.

I have been experimenting a little with GPS (Global Positioning System), which is basically a group of at least 24 Medium Earth Orbit (MEO) satellites placed around the globe, originally for military purposes, to give accurate position, time and speed. The combined GPS receiver/antenna that I use is shown in the page masthead. It measures about 6.0 x 4.5 cm and cost only £20 on ebay (£10 for the unit from USA and £10 post, packing and insurance.

Many of us can also use another method for synchronising our PCs—the atomic time signal from Anthorn in Cumbria on (MSF 60 kHz), formerly at Rugby, and Frankfurt, Germany (DCF 77 kHz), which can also be linked to your PC; but as I see it, GPS is the cheap and easy way to go, units with receivers and antennas combined now costing from around £20 new.

A GPS receiver can also serve another purpose. If you have a laptop, Palm Pilot or even certain mobile phones, you can use the GPS just like a standard car GPS system. I know! I tried it and it works. You can have great fun, fox-hunting, playing guessing games, fun for the whole family. A GPS system for £20! Wow! I wonder how many of you will be trying this now? Have I got your attention yet?

What we are really concerned with here is weather satellite applications, so I will use examples in the software I use and how to apply it.

One piece of software I use for APT reception is APTdecoder written by Patrik Tast of Finland. I use this mainly because it's free and it meets the needs of my APT station, providing excellent results completely automatically. Figure 1 shows the ground station screen, which opens when you select *Settings/Ground station.* When you click on the GPS logo, the GPS screen appears (figure 2). On the GPS screen, first click *Setup device* to reveal the GPS Setup screen. Now click the *port* arrow to select the port your gps device is connected to. If you don't know which port to select, right click My Computer-Properties-Hardware-Device Manager-Ports, where you will be shown which port you are using.

Figure 2

Then click *Find GPS device:* the software automatically searches for it and the data starts rolling in showing your latitude, longitude and altitude. Enter your station details, then click *Add* followed by *OK* to save. You can also update your station info and add more stations using the add, select and update icons. There is also a button for synchronising the time. I'm well impressed.

Another instance where I use GPS is with my registered version of David Taylor's satellite tracking software *WXtrack*. (The GPS option does not apply to the unregistered version). On the *Setup* tab, click the Edit button in the 'My location details' panel and in the edit box that appears (figure 3) edit your location details. Click on *Setup GPS Port* to open another edit box (figure 4), where you can enter the COM
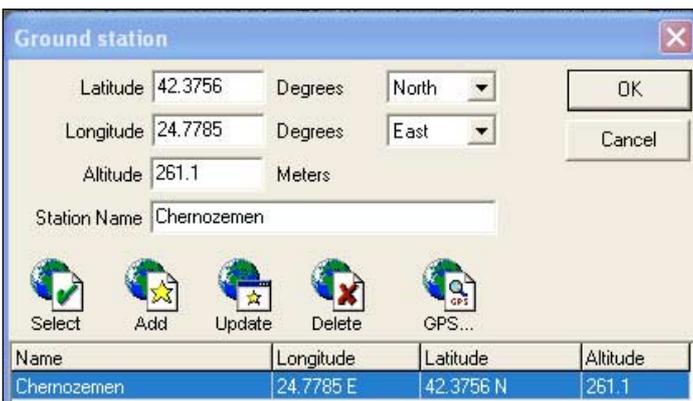

Figure 1
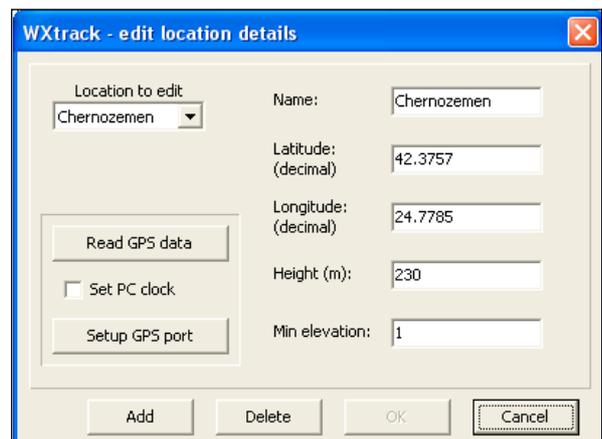
Figure 3
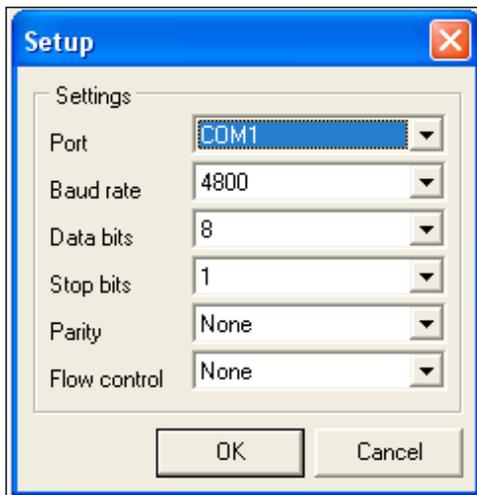
Figure 4

port settings etc. These settings vary with systems but I found the universal settings which work for me are: Baud Rate 4800, data Bits 8, Stop bits 1, Parity None, Flow None. You don't have to know what this means (I don't) but these settings work on all my weather satellite software. Once the details are entered, simply click *Read GPS Data* and your coordinates are automatically displayed on the screen. This saves trying to work out your location and entering all the details manually.

I'm certainly not an expert on GPS: in fact I'm just learning by experimenting. I am also running a *Trimble* GPS system here. If there is sufficient interest I will write an article on that. It really sings and dances and I got mine for free from a friend. It can also be used with Google Earth and other software.

So, to round off, next time you hear 'GPS' remember: this is a system which can greatly help you in your weather satellite applications for very little outlay. It is not as outdated as some may think. In fact, another GPS satellite was recently launched!

Pigeons in my Meteosat Dish

Anthony Lowe

Ever since David Taylor showed us an image of birds on his X-dipole, several other readers have followed suit. But my bird image is a little different.

Following Meteosat-7's final image I intended to get the ladders out and take the dish down—but I still haven't got round to this and the dish remains in situ.

I have had problems over poor reception due to nearby conifers, and last summer my next door neighbour promised to have them cut back. On Friday March 14, I came home and found, to my surprise, that the conifers had been reduced by some six feet. Once again it has been a pleasure to receive images from the far Atlantic.

But there was one snag: the trees had been cut down during nesting time, and two wood pigeons had been made homeless. Normally, my X dipole was their usual perch but for the next 48 hours they were nowhere to be seen—until I eventually spotted them perched on top of the old Meteosat dish. Shortly after I noticed they where collecting twigs to build a new nest. As the photograph on the inside back cover illustrates, they have now built a new family home directly behind the dish, and there is now a youngster among them. I've never been a 'feathered' bird watcher before but on this occasion I have stuck a webcam to the inside of a window from where they can easily be observed.

So I now have another excuse not to climb any ladders!

Cover and Full Page Images

Front Cover

This image of a major Saharan dust storm blowing across Cyprus was captured by the MODIS flight instrument aboard NASA;s *Aqua* satellite. You can read eye-witness reports of this event in an article starting on page 36.

Image: MODIS Rapid Response Project at NASA/GSFC

Inside Front Cover

David Taylor spotted this fascinating double depression off the Pacific coast of Canada, dating from February 23, 2008, on a GAC composite image produced on his AVHRR Reader software.

Inside Back Cover

Top: This splendid March 5 Metop-A image was acquired by Alan Banks, and shows northwest USA and western Canada in the grip of winter. The loop of the Columbia River and the Cascades volcanoes, Mounts Rainier, Adams and St Helens in Washington State show up particularly well.

Image © EUMETSAT 2008

Lower Left:
Anthony Lowe sent in this photograph showing two wood pigeons actually nesting in a disused Meteosat wefax dish. At the time of writing, the first chicks had hatched.

Lower Right:
Nick Bird sent this photograph of a crow perched on his turnstile antenna to Francis Bell, who forwarded it to the Quarterly.

Back Cover

Jean-Louis Fenasse sent us a superb false colour NOAA-18 HRPT image that he acquired from the 12:46-13:01 pass on February 25, 2008, from his location near Nice in the south of France. Reception lasted an amazing 14 minutes 56 seconds and stretched deep into the Sahara. The northern part of the image is reproduced. Reception was achieved using *WinHRPT* software while the false colour processing was done using David Taylor's *HRPT Reader*.

Page 14

This remarkable image of the Antarctic Peninsula, completely free of cloud, was captured by *Terra's* MODIS instrument on February 26, 2008.

Image: MODIS Rapid Response Project at NASA/GSFC

Page 29

Mike Stevens downloaded this fine Metop-A image providing amazingly cloud-free views of Patagonia, Tierra del Fuego, the Falkland Islands and the Antarctic Peninsula on March 3, 2008.

Image © EUMETSAT 2008

Page 40

This beautiful image from Metop-A, stretching from Hudson Bay to Georgia, shows North America beset by ice and snow. Mike Stevens received it on February 28 this year, via *EUMETCast*.

Image © EUMETSAT 2008

Page 44

Mike Stevens downloaded this fine Metop-A image showing an interesting cloud formation over the Gulf of Aden at 06:13 UT on February 26, 2008.

Image © EUMETSAT 2008
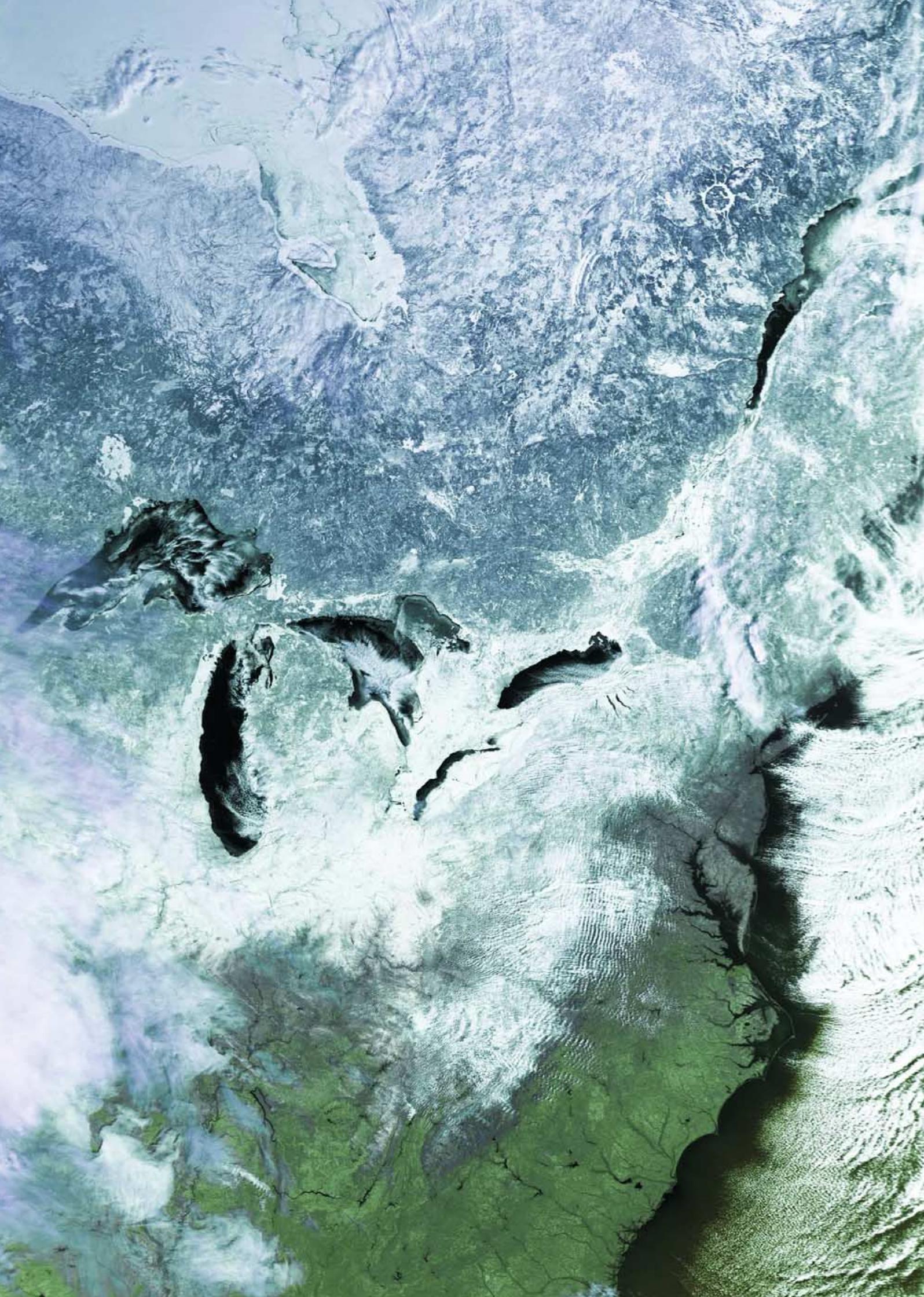
Computer Corner
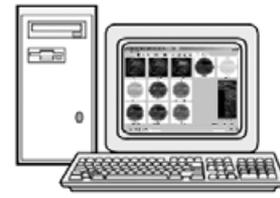
Douglas Deans – dsdeans@tiscali.co.uk

Welcome to this new look column which has been renamed to better reflect the change in content. As was announced in the previous *GEO Quarterly*, the Software Library has now been discontinued. The readily available and inexpensive access to the Internet by Broadband now means that the simple, immediate and no-cost route for the latest software is by download. This has been reflected in the huge drop in demand for CDs over the past few years. My thanks to all those who supported the library.

Following my request to the membership for comments on my suggestion of including a small Q and A section on computers/software, the responses I have received have all been very positive. My thanks to all those who took the trouble to contact me. So starting this issue, I propose to include, on an experimental basis, a few questions and answers relating to computer issues. I would welcome feedback both on the content and presentation. Perhaps a few introductory words of explanation concerning this new part of my column would be beneficial.

GEO Quarterly is not, of course, a computer magazine: there are plenty of those available to purchase elsewhere. However, we cannot ignore the fact that, to fully enjoy our hobby, the use of computers is essential. I offer a helpline service, along with others, to GEO members (see centrefold iii for details) and I have found that the resolution of some problems is exacerbated by an inability to carry out certain basic computer operations. Again, as I said in my last column, this is not a criticism but a factual comment. My intention, therefore, is to field questions and answers that are most relevant and helpful to our specific hobby; I will also be dealing with issues most commonly encountered during helpline discussions.

Undoubtedly some readers will find certain questions very basic but nevertheless they *are* the ones that have created problems. Let me also make it very clear that, whilst I consider myself to be computer literate, I am no expert and certainly there will be readers who may see better or alternative solutions to some of the matters raised. It also has to be remembered that often there may be several ways of getting the same result in a computer operation; the best method may not necessarily be the quickest but the one with which you are most comfortable.

I will also continue to report on any software updates as and when I spot them and provide readers with the relevant links for download of the latest information and software.

As David Taylor has produced such a large suite of satellite-related software, which is regularly updated, and as many of the questions do relate to this software, I intend to list the latest versions of his programs in each issue.

Computer Q and A

There are two issues I would like to address this quarter, both relating to the need to view the contents of your **hard drive**.

I often find that I have to ask a caller to open a particular file within a folder. However, a file is defined not just by its name but the extension that follows—that is the bit after the full stop. So a file called *Douglas.jpg* is quite different from one called *Douglas.txt* (the first would be an image file and the second a text file). By default, Windows XP and Vista both hide these file extensions. So if the two above files were sitting in the same folder they would both show as *Douglas*. This can make identification difficult and demonstrates the need to be able to view file extensions. This can be easily remedied.

To show file extensions on XP
- Open Control Panel
- Select Folder Options
- Select the View tab
- In *Advanced settings*, untick 'Hide extensions for known file types'

To show file extensions on Vista :-
- Open Control Panel
- Select Folder Options (see my comments below)
- Select the view tab
- In *Advanced settings*, untick 'Hide extensions for known file types'

Just a comment about the *Control Panel* in *Vista*. There are two viewing options for this, comprising *Control Panel Home* and *Classic View*. Personally, I find *Classic View* much simpler to use, and far easier for finding specific headings as each has

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Software Updates

APT Decoder v 2.0.5.81 (15th March 2008)
There have been a number of updates to this excellent program from Patrik Tast. Let me remind you that this software, which is free, can be used to record and decode APT transmissions and has a host of other very useful features. Updates and fixes include:

- Fixing an exception when the R2FX receiver was tuned from the tuner window
- Added a detailed process list to the process window
- Users can define how many days to keep the same log in the General settings Web tab
- Daily log options.
- Modified NOAA 17 channel parser

To learn more about this program and to download the latest update please visit

http://www.poes-weather.com/

and follow the relevant links.

David Taylor's programs
The latest releases at the time of writing were

Program	Version
ATOVS Reader	v 1.1.2
AVHRR Manager	v 1.5.0
DWDSAT HRPT Viewer	v 1.0.4
GeoSatSignal	v 6.1.2
GRIB Viewer	v 2.1.6
GroundMap	v 2.0.6
HDF Viewer	v 1.2.0
HRPT Reader	v 2.7.2
Kepler Manager	v 1.2.8
MapToGeo	v 1.1.4
Metop Manager	v 1.2.2
MSG Animator	v 2.5.18
MSG Data Manager	v 2.5.18
PassControl	v 3.1.0
SatSignal	v 5.1.0
Sea-Ice & Viewer	v 1.3.4
Wxtrack	v 3.6.8

To learn more about this program and to download the latest update please go to :-

http://www.satsignal.eu
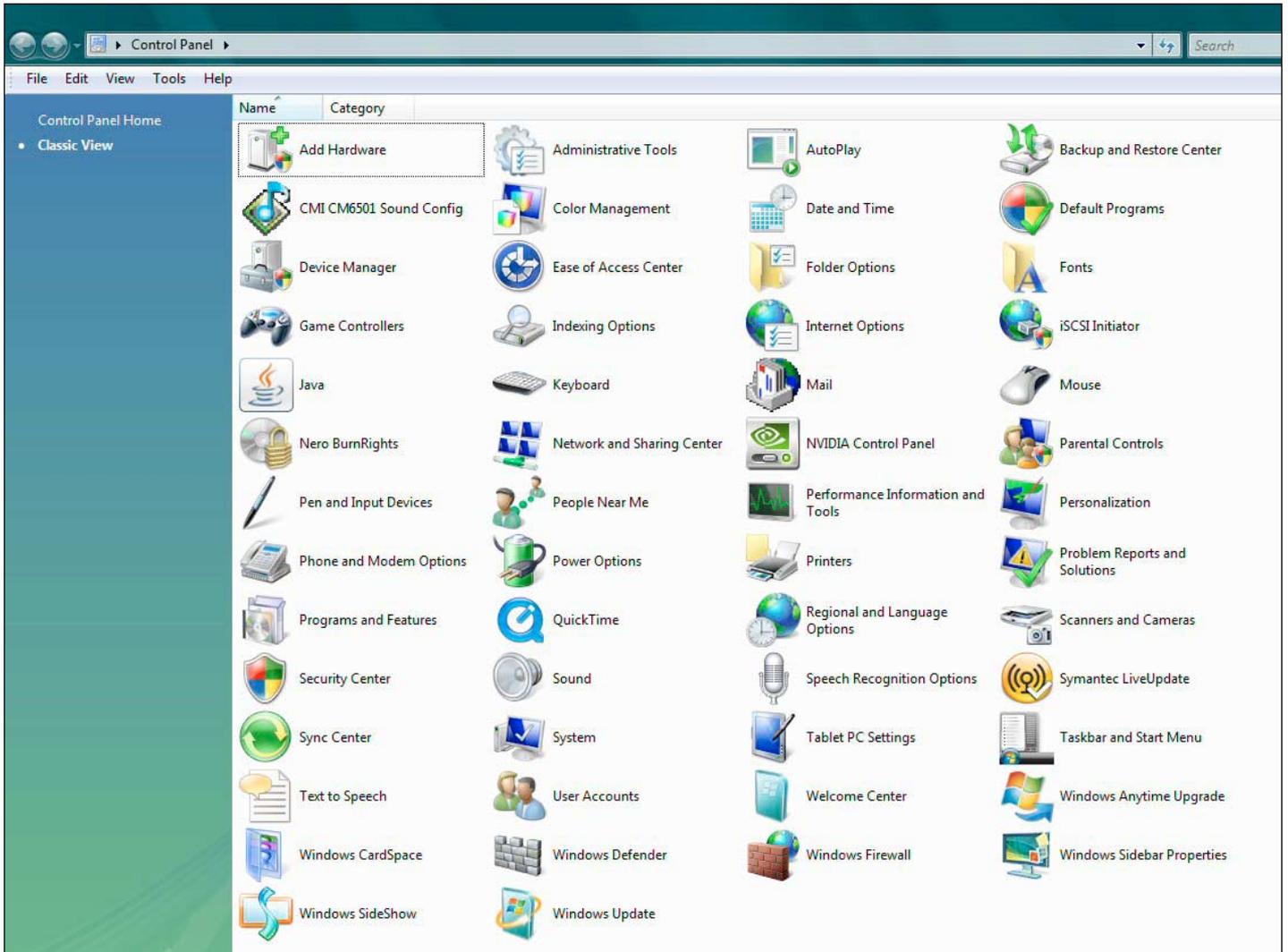
The Control Panel Classic View where each option has its own icon
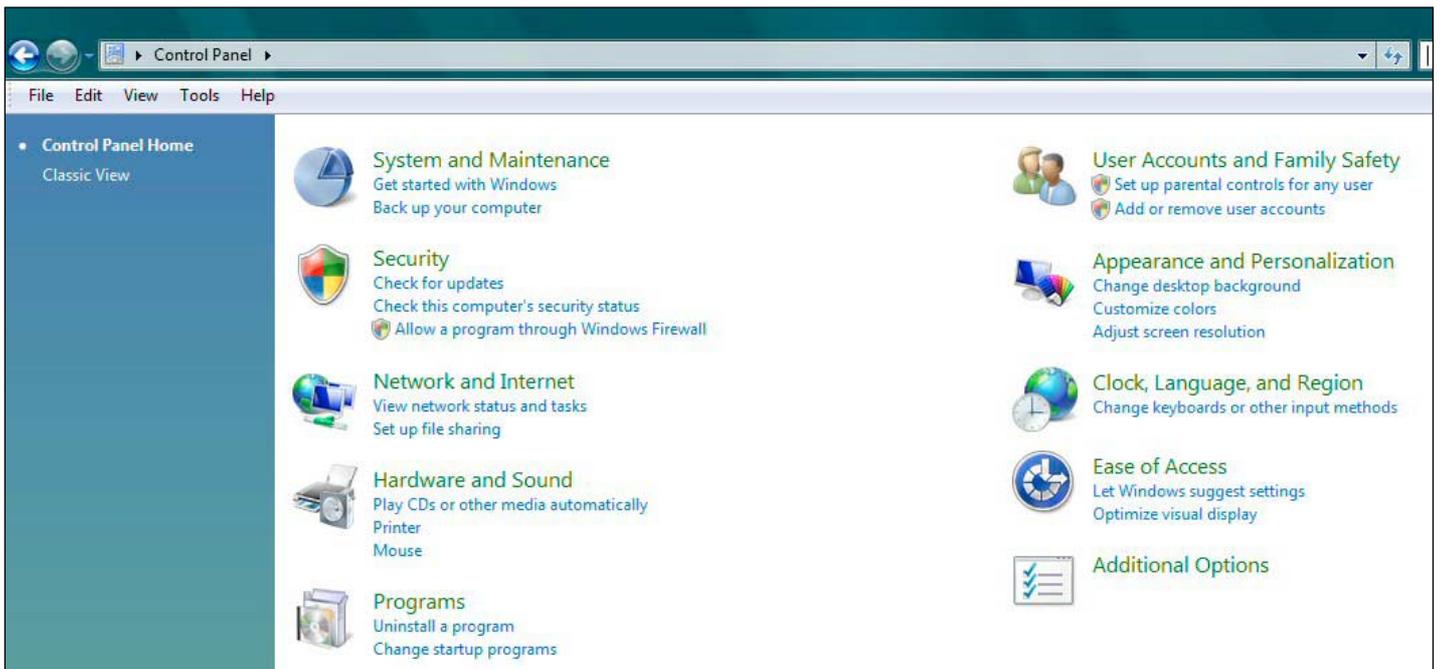
The Control Panel Home screen where options are hidden behind folder icons

its own icon. *Control Panel Home* is broken down into groups and it can be difficult to find a topic within a group. For example '*Folder Options*' is in the '*Appearance and Personalisation*' group: but you can't see that until you actually open it (see images at left). You may waste time checking other groups before you find it.

Another important issue is being able to look at the content of your hard drive so that you can check folders/files. There are several ways to do this.

Checking Folders/Files in Windows XP
The best way here is to use *Windows Explorer* (do not confuse this with Internet Explorer). This is a fundamental application within Windows which shows you how your computer is organised and makes looking at folders and files very straightforward.

To open Windows *Explorer, go to* the *Start button* then follow *All programs → Accessories* and it is listed there. A shortcut for this is extremely time saving and can simply be done by dragging and dropping on the desktop.

It is also possible to simply click *My Computer* and then select your hard drive. However, whilst this does show the full contents of your drive, it does not include other drives such as DVD writers etc., which are shown in the *Explorer* option.

Checking Folders/Files in Vista
The simple way to do this is to click the Widows *Start* button and select *Computer* (or use the desktop icon).

Click on your hard drive reference (example Local Disc (C:)) and drag it on to the Desktop as a shortcut. You now have an immediate way to bring up a window showing the hard drive contents as well as other drives, network information etc. Note that when you select *Computer* from the *Start* button, you can in fact drag that on to the desktop (if it is not already there) as a shortcut but I find this less useful as the C: drive contents are not immediately displayed as they are with the previous method described.

It is also possible to do this using *Windows Explorer* which can be found from the Windows *Start* button and following *All programs → Accessories → Windows Explorer*. Again, a shortcut can be placed on the Desktop for quick access. The *Explorer* method also has the disadvantage that the C: drive is not opened immediately on the display. There is a way to do this but that is for another day.

This article has looked at two very fundamental issues. In future columns I hope to also include some more advanced options.

The Column for Readers' Letters and Queries

email: geoeditor@geo-web.org.uk

EUMETCast Without RAMdisk

Well, as promised, here is my letter regarding the working conditions of my system which did cause some controversy at the time. However, it's been over one year since the separate USB hard drive was placed into operation and I have to say it has worked perfectly with no overheating or failures of any kind. And the pictures of course have been stunning.

Ever striving to achieve the best results possible, I am now in the process of modifying the complete system to have a dedicated Metop PC but it has not been without its problems. Whilst in the process of setting up, my Acer laptop failed big-time. I was planning on a three-computer system, so this has now come to a standstill while waiting to have it repaired.

At the moment I am using a low specification ASUS PC as the receiving unit and networking with the E-Machine which does all the decoding, with excellent results. The Lacie hard drive is still in the system for back up and file and picture storage.

Well that's it for the moment. I will let you know when I can restart my experiment again. It will all depend on what happens with the laptop and whether it is powerful enough to be used as part of the new system. In the meantime thanks to everyone for your help and advice. Best wishes and a happy weather watch from Portland.

Mike Stevens (G4CFZ), Portland, Dorset.

SatScape Problem

Having recently had a glitch with my SatScape program, I thought that other members may have had the same problem and have not worked out what was the cause.

I recently started up SatScape v 1.87 on my PC running Windows 98, only to find that part-way through start-up an error message came up: 'An illegal action has taken place.' The program promptly closed down. I then tried to open the software on my Windows XP Home PC, only for another error message to appear: 'Wx tracking error.' Again, the program closed down.

I tried reloading v1.87 from CD, but again, still the same error messages. I then downloaded SatScape from the Internet, which was SatScape v 2.02. Once loaded, this version perfectly on both PCs.

The following morning, having had time to think about the subject, I deleted SatScape v 2.02 from the Windows 98 PC and reloaded SatScape v 1.87, which now worked perfectly! The reason for my problem was that the day before was the February 29; clearly, Satscape v 1.87 did not recognise that date.
Oh yes! Why go back to version1.87? Just personal preference, as I do not like the menu start-up window always being active on v 2.02 whereas, with v 1.87, pressing F3 takes you to the next window and closes the start-up one.

Laurence Holderness, Pembrokeshire

Interference to APT Satellite Reception

APT receiving antennas are (or try to be) omnidirectional. Fortunately, the orbits of the Orbcomm and NOAA satellites are sufficiently different that the interference is relatively rare.

Conclusion

This brief article has attempted to describe several commonly encountered types of interference that may be experienced by amateurs receiving weather satellite transmissions. As with many problems of this type, every case tends to be different, because of the different locations, receiver types, feeder cables and antennas in use.

Because of this, a certain amount of try-it-and-see experimentation is called for if the approaches described in the article do not work straight off. Good luck!

The author of this article is willing to offer advice on the subject of interference. Please email

alan.sewards@free.fr

If you can attach a small image to the email, preferably in jpg format, which shows the problem, together with a description of your receiving system, this will greatly help the diagnosis.